# HISTORY

OF THE

# INTRODUCTION OF PURE WATER

INTO THE

# CITY OF BOSTON,

WITH A

## DESCRIPTION OF ITS COCHITUATE WATER WORKS.

ILLUSTRATED BY MAPS AND PLANS.

COMPILED BY A MEMBER OF THE WATER BOARD.

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1868.

CITY OF BOSTON.

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COCHITUATE WATER BOARD OFFICE,
CITY HALL, January 28th, 1868.

At a meeting held this day, it was

*Voted*, That the thanks of the Board be tendered to their respected associate, Nathaniel J. Bradlee, Esquire, for his faithful, clear and interesting History of the great enterprise of INTRODUCING PURE WATER INTO OUR CITY, with a description of the WORKS.

Per order.

JOHN H. THORNDIKE,
*President.*

S. N. DYER, *Clerk.*

# PREFACE.

HAVING occasion to seek for myself information on some subjects connected with the Water Works of this City, my researches showed me that the facts relating to them were scattered in various records and places.

The means of collecting those necessary facts and documents are becoming more difficult every year; and all persons officially or generally interested in the subject must continually feel the necessity of having them together and accessible.

Such were the motives for the compilation. In preparing these Annals, an arrangement was adopted that admits of their being carried on by additions or supplements from year to year: and it was thought best to commence with an account of the early proceedings of the citizens on the subject of the introduction of Pure Water into the City, which finally resulted in the Works; so that in future years, the citizens might know what difficulties and obstacles had to be encountered, before this noble enterprise could be carried into execution.

Even at the present time, many have forgotten the great excitement and party feeling on this subject, and the various projects that were brought forward from time to time, between the year 1825 and the year 1846, when the works were commenced.

In order that the account should be as correct as possible, it has been compiled from the Records of the City Government, the newspapers of the day, and from documents in the possession of the Cochituate Water Board. Every action on this subject taken by the City Council and citizens, so far as known, is mentioned; extracts are given from all Reports that were deemed of interest, and all Orders and Resolves are given in full.

In reviewing the past history of the introduction of water into the City, it must be borne in mind, that LONG POND is the present LAKE COCHITUATE, the name having been changed after its purchase by the City.

A MEMBER OF THE COCHITUATE WATER BOARD.

Boston, January 1st, 1868.

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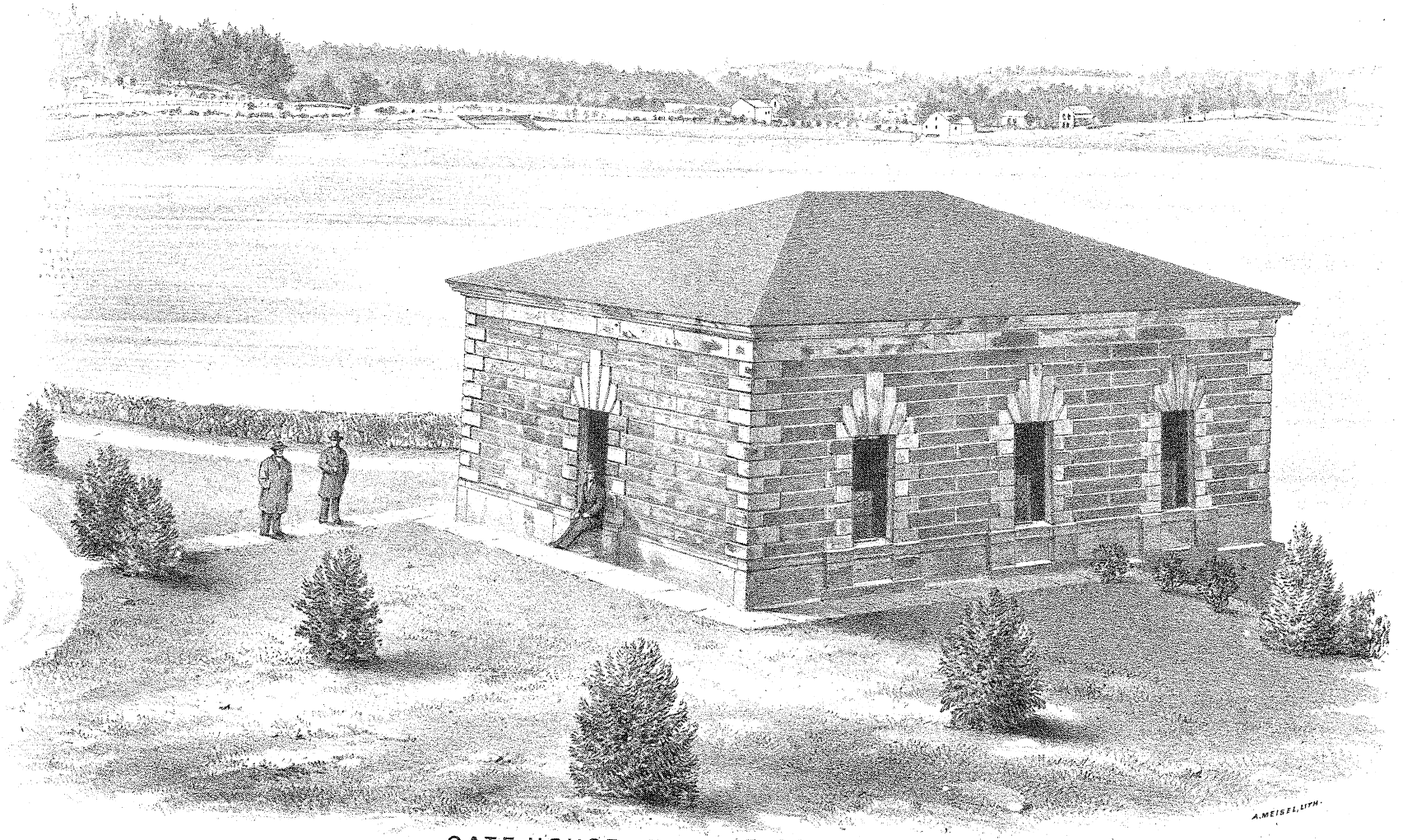
# PART FIRST.

PROCEEDINGS OF THE CITIZENS AND THE CITY GOVERNMENT ON THE SUBJECT OF THE INTRODUCTION OF WATER INTO THE CITY OF BOSTON, UP TO THE YEAR 1850.




GATE HOUSE AT LAKE COCHITUATE.

1652.]

# CHAPTER I.

## 1825 TO 1832.

Conduit — Jamaica Pond Aqueduct — Supply from Spot Pond — First action of the City Government — A Committee chosen to consider the expediency of introducing Water — Report of the Committee — First appropriation made — Professor Daniel Treadwell appointed a Commissioner to make a survey — His Report — Letter of Dr. John C. Warren — Mayor Quincy's address — Proposition of George and Thomas Odiorne — Mayor Otis' Address.

PREVIOUS to the year 1825, there was no public action on the part of the citizens of Boston to introduce, at the expense of the City, a supply of pure water, although it had been partially introduced by two private companies.

Dr. N. B. Shurtleff, in one of his articles on "BOSTON IN THE OLDEN TIME," gives a full account of the "ANCIENT CONDUIT," and also of the "JAMAICA POND AQUEDUCT COMPANY" and by his courtesy, we make the following extracts.

Of the "ANCIENT CONDUIT," he says, "among the most noted of the early attempts for procuring water for the daily use of the towns' people was the CONDUIT, a very singular contrivance, but one which answered a very good purpose in the limited space in which its benevolence was experienced. . . . . In 1652, at the May Session of the General Court of the Colony, on petition of the inhabitants of Conduit Street in Boston, 'The Water Works Company' was incorporated for building the conduit, and provisions were made for the use of the water in case of fire.

"From what has been stated, it would appear that the conduit was a large reservoir, about twelve feet square, made for holding water, conveyed to it by pipes leading from neighboring wells and springs, for the purpose of extinguishing fires and supplying the inhabitants dwelling near it with water for domestic purposes. Over the reservoir was a wooden building, in the olden time, used for storage purposes; but in more modern days, the old building was removed, and the conduit covered with plank, raised in the centre about

two feet, and sloping to the sides, like a hipped roof. . . . . This strange construction was situated in a square formed by the junction of Wing's lane (now Elm Street,) and Union Street, in the neighborhood of the present North Street, and a short distance from Dock Square. The street leading from the conduit to the Draw Bridge placed over the Mill Creek, now the site of Blackstone Street, was one of the first highways laid out by the early settlers of the town, and was for a long time known as Conduit Street, because the proprietors of the conduit owned an estate on the north side of the street, about where the old building stands, now occupied by Joseph Breck and Sons as an agricultural warehouse. . . . . .

"The old conduit never fulfilled the expectations of those who devised and built it; and its traces have so entirely disappeared, that not a single vestige of it can be found, and an occasional mention of the street that bore its name, and the old estate alluded to, is all that can be found concerning it in the ancient town books and in the conveyances of land in Suffolk Records. No digging in the street, for laying of drains or sewers, has, within the remembrance of persons now living, shown any of its remains, although it was well remembered in its last condition by the old persons who have recently passed away. . . .

"The exact position of the conduit is marked out on John Bonner's plan of the town, engraved in 1722, and has been pointed out by antiquaries as being near where the present North Street and Market Square join Union Street, just west of the 'Old Feather Store,' which was taken down between the 10th and 13th of July, 1860."

In another article, giving an account of the "JAMAICA POND AQUEDUCT," he says: "On the 27th of February, 1795, Governor Samuel Adams approved an Act of the General Court whereby Luther Eames, Nathan Bond and William Page, and their associates, were vested with corporate powers for the management and direction of the business, as a Company, of bringing fresh water into the town of Boston by subterraneous pipes; and, by a subsequent Act passed on the 10th of June, 1796, this Corporation was empowered to assume the appellation of 'THE AQUEDUCT CORPORATION.'"

The Corporation was authorized "to bring from any part of the town of Roxbury into the town of Boston, and into any street in the same town, all such fresh water as they, the said Luther Eames, Nathan Bond and William Page, and their associates, or any, or either of them, in their private and natural capacities 'then had or hereafter should' have a right to dispose of or to convey from the springs or sources thereof." The act gave power also to open the ground in any of the streets or highways in Roxbury and Boston as should be required for the sinking of the water pipes, but with very prudent

provisions, which prevented the aqueduct from becoming a nuisance, or impairing any right of the town of Roxbury or any of its inhabitants in and to the waters of Jamaica Pond.

"The Corporation could hold only thirty-three thousand dollars in real estate, and the water works were to be divided into one hundred shares.

"The price of water was to be regulated by the General Court, the towns of Boston and Roxbury were to have the privilege of hydrants for extinguishing fires, and the first meeting was to be called by Hon. James Sullivan upon the proper application of the persons named in the act. On the 22d of June, 1803, an Additional Act was passed to facilitate the operations of the Corporation.

"The Capital of this Company, so far as can be ascertained, was about one hundred and thirty thousand dollars, or about thirteen hundred dollars to a share, which became much depreciated in value.

"No dividends were made during the first ten years after the commencement of the works, and subsequently the average of the dividends for thirty years amounted to a fraction less than four per cent a year. When the Aqueduct was in its greatest prosperity it supplied about fifteen hundred houses with water, chiefly at the South End, and in the neighborhood of Summer and Essex, and of Pleasant and Charles streets.

"The water was brought from Jamaica Pond in Roxbury through four main pipes of pitch-pine logs, two of four inches bore, and two of three inches, the lateral pipes having a bore of one and a half inch. The lineal extent of the water pipes in Boston was about fifteen miles, and they reached north as far as Franklin Street, and branched off easterly through Harrison Avenue into Congress Street nearly to State Street, and to Broad Street. They also branched off westerly through Pleasant and Charles streets, extending as far as the Massachusetts General Hospital, which was supplied with Jamaica Pond water." In 1840, this Company laid a 10-inch iron pipe from the Pond to Bowdoin Square.

In 1816, Cyrus Alger and others took some measures for the introduction of water into the town of Boston from Spot Pond in Stoneham, but upon further investigation they found it would be inexpedient.

THE FIRST ACTION OF THE CITY GOVERNMENT OF BOSTON, IN REGARD TO A SUPPLY OF WATER FOR THE CITY, WAS TAKEN ON THE 19TH OF MAY, 1825, when a Committee was chosen, Mayor Quincy being its chairman. That Committee were instructed to inquire into the practicability, expense and expediency of supplying the city with pure water.

On the 13th of June following, they made their Report, in which they say:

"There can be no question concerning its practicability or expediency, and the only question, is the expense, and the mode in which it can be effected. They believe that capitalists may be found willing to join the city in carrying into effect such an undertaking, but whether such association ought to be formed, or whether it ought wholly to be left to private enterprise, or wholly effected at the expense of the city, are questions on which there is a diversity of opinion, and no plan should be adopted without great deliberation: and they recommend that a survey be made, at the expense of the city, of the sources from which a supply could be obtained."

On the same day an Order was passed authorizing the Mayor and Aldermen, to cause such survey to be made, and the sum of one thousand dollars was appropriated to pay the expenses thereof. On the 11th of July, the Mayor in behalf of the Board, appointed PROFESSOR DANIEL TREADWELL, A COMMISSIONER "to ascertain the practicability of supplying the city with good water for the domestic use of the inhabitants, as well as for extinguishing fires, and for all the general purposes of comfort and cleanliness."

PROFESSOR TREADWELL made his report November 4th, of the same year, covering with his estimates twenty-nine pages, of which we make the following abstract.

He says: "It is a matter of no small difficulty to fix, satisfactorily, upon the quantity of water which any works, worthy of the City, ought to supply. The former water works of the City of Philadelphia, supplied 1,000,000 gallons daily, to about 60,000 inhabitants. This was found so insufficient, as to render it necessary to alter and enlarge the works, at a great expense, and they were then made capable of supplying 3,000,000 gallons, daily.

"The present (1825) supply of London, according to Professor Leslie, amounts to 29,160,000 gallons, daily; this quantity, he says, is abundantly sufficient; the rivalship of the several water companies having almost deluged the streets.

"The population of London, within the district supplied by the water companies, is to that of Boston as 20 to 1, nearly; consequently, 1,458,000 gallons distributed to this city, would be in proportion to the London supply.

"Taking the inhabitants of Boston at 50,000, collected into 8,000 families, and supposing each family to use 60 gallons for washing, and on the same day 40 gallons for all other purposes, we have 100 gallons to each family. As not more than 6,000 families would be likely to wash on the same day, we may take, as the greatest quantity required on any one day, 6,000 families, 100 gallons each, and the remaining 2,000 families, 40 gallons each, making 680,000 gallons. Now, if we take the other ordinary demands, by the trades,

and for watering cattle, streets, etc., together with the loss by leaks and waste, at 500,000 more, we get 1,180,000 gallons as the maximum for daily consumption, allowing every family to use the water. Making an allowance for the increase of the city, the supply ought not to be less than 1,600,000 gallons. Although this falls below the quantity, which from the example of Philadelphia, would seem to be required, yet from the above computation, I think it must appear an ample supply.

"I have not taken into the above account, the supply required for extinguishing fires. In such an emergency, the use of water, for most other purposes, must be forbidden, and under this condition, works capable of furnishing the above quantity of water for ordinary purposes, will furnish at a fire over 1,100 gallons a minute, a quantity equal to that used by eight large fire engines." "In addition to this, by having Reservoirs generally full in the city, a still further security, so far as a supply of water can render a city secure, will be obtained."

He then says "there are several places within the neighborhood of Boston, from which 1,600,000 gallons of water, or more, may be obtained daily. Two of these, CHARLES RIVER, above the falls of Watertown, and SPOT POND, in Stoneham, appear to possess advantages over all others.

"The water of Charles River is at all times abundant for the supply of the city, although it is not sufficiently elevated to be distributed, without being at first raised by artificial means. But Spot Pond is 140 feet above the tide-water, and consequently its water may be brought to the highest land in the city, by an aqueduct, without any further elevation." He then states how it should be brought from Charles River, and from Spot Pond; estimating the cost of bringing water from Charles River at $514,842, and from Spot Pond from $558,353 to $615,469, according to which of two routes, which he designates, should be taken. These estimates are all given in detail.

On the 14th of November, 1825, the committee submitted the above report to the City Government, and the whole subject was referred to the next City Council.

On the 23d of the same month, Dr. John C. Warren, feeling the necessity of the case, wrote a letter to the Mayor on the importance of a supply of pure water, urging the immediate action of the City Government. This letter, with others, is referred to by Mayor Quincy, in his Inaugural Address, made January 1826, in which he says: "Among the objects to which the attention of the City Council will be drawn the ensuing year, is that of a sufficient and never-failing supply for our city, of pure river or pond water, which shall be adequate for all purposes of protection against fire, and for all culinary and other

domestic purposes, and capable of being introduced into every house in the city. I deem it my duty to state unequivocally, this object ought never to be lost sight of by the City Council, until effected upon a scale proportionate to its convenience, and our urgent necessities.

"Physicians of the first respectability, have urged this topic upon me, in my official capacity, on the ground of health, in addition to all the other obvious comforts and advantages to be anticipated from an adequate supply of such water. The spring water of Boston they assert to be generally harsh, owing to its being impregnated with various saline substances; and that this impregnation impairs its excellence as an article of drink, and essentially diminishes its salubrity.

"In the course of their practice, they say they have noticed many diseases to be relieved and cured by an exchange of the common spring water for soft water of the aqueduct, or distilled water. Hence they have been led to the opinion, that many complaints of an obscure origin, owe their existence to the qualities of the common spring water of Boston. The introduction of an ample supply of pure water, would therefore, they apprehend, contribute much to the health of the place, and prove one of the greatest blessings which could be bestowed on this city.

"I am induced to bring this subject before the City Council on the present occasion, thus distinctly, from having been informed that citizens among us of the highest respectability, both in point of talents and property, seriously contemplate an association for the purpose of supplying this city with water, and of making application to the Legislature for an act of incorporation for that object, — an attempt which, if made, I trust will be met by the City Council with the most decided and strenuous opposition, and with a corresponding spirit and determination to effect this great object solely on account and with the resources of the City.

"On this topic, I deem it my duty to declare explicitly my opinion, that in such a project the City ought to consent to no copartnership. If there be any privilege which a city ought to reserve exclusively in its own hands, and under its own control, it is that of supplying itself with water. No private capitalists will engage in such an enterprise without at least a rational expectation of profit. To this, either an exclusive right, or privilege of the nature of, or equivalent to, an exclusive right, is essential. There are so many ways in which water may be desirable, and in such a variety of quantities, for use, comfort, and pleasure, that it is impossible to provide, by any prospective provisions, in any charter granted to individuals, for all the cases, uses, and quantities which the ever-increasing wants of a great city in the course of years may require.

"Besides, it being an article of the first necessity, and on its free use so much of health as well as comfort depends, every city should reserve in its own power the means, unrestrained, of encouraging its use, by reducing as fast as possible, the cost of obtaining it, not only to the poor but to all classes of the community. This never can be the case when the right is in the hands of individuals, with anything like the facility and speed as when under the control of the city.

"In addition to these considerations, the right to break up the streets, which that of supplying the city with water implies, ought never to be intrusted to private hands, who through cupidity or regard to false economy, may have an interest not to execute the works upon a sufficiently extensive scale, with permanent materials, thereby increasing the inconvenience and expense which the exercise of the power of breaking up the streets necessarily induces." . . . The Mayor then gives an extract from a letter received by him from the superintendent of the Philadelphia water works, Joseph S. Lewis, Esq., from which we take the following: "Your object should be to have enough and to spare, and the calculation should be formed on one hundred and fifty gallons for each family, which will afford a supply for washing the streets, waste by leakage, etc., and the experience of this city (Philadelphia,) fully justifies me in saying, that it is not too much, although in London a less amount is made to answer."

On January 5th, that part of the Address of the Mayor above mentioned, together with Professor Treadwell's Report, was referred to a special committee, Mayor Quincy being its chairman, to ascertain the expense of the sources recommended.

This committee on the 12th of the same month, asked leave to have further surveys made, which was granted, but there is no record to be found of their report, if they ever made one.

In the following year, February 5th, 1827, George and Thomas Odiorne, owners of Spot Pond, in Stoneham, offered "to supply the city with fresh water from said pond, to be conveyed by an aqueduct, provided the City Government would approve of the project, and prescribe such reasonable rules and regulations for the management, distribution and conducting the water, as would to their minds present a prospect of remuneration; at the same time giving the city certain privileges for fire Hydrants, and for other purposes." This was referred to a committee, who reported in November, "That it was inexpedient to take any action thereon."

During the year 1828, there was no action on the subject.

The following year, 1829, Mayor Otis in his Inaugural Address, January 5th, alludes to the want of a supply of water thus: "There is, however, wanting to the city, a convenience of which, it is ventured to assert, it should never lose sight, — an abundant supply of wholesome water. The object has been placed before the City Council on a former occasion by my predecessor, in striking relief, and I am free to avow my conviction of the correctness of the views by him exhibited in relation to it." . . . But there was no action on the subject during the year.

During the years 1830 and 1831, the subject was not brought to the notice of the City Government.

# CHAPTER II.

## 1832 TO 1837.

Committee on Water chosen 1832 — First application to the Legislature for an Act — New survey ordered — Col. Loammi Baldwin appointed to survey — His Report — Report of the Committee — Appropriation made — Petition of Dr. John C. Warren and others — Committee on Water chosen 1832 — Third survey ordered — Petition of Isaac Parker and others — Report of the Committee — Robert H. Eddy appointed to make a survey — His Report — Boston Hydraulic Company — Third appropriation made — Meeting at Faneuil Hall — Resolutions passed — Memorial of the Boston Aqueduct Corporation — Report of the Committee to whom were referred the Resolutions and memorial.

JANUARY 9TH, 1832, a committee of the City Government was chosen, the Mayor, Charles Wells, being its chairman, to consider and report upon the "practicability, expense and expediency of supplying the city with water," and on December 31st, of the same year, they reported that the further consideration of the subject be referred to the next City Government.

Upon the twenty-first of January, the next year, 1833, another committee was chosen, Mayor Wells being its chairman, with the same instructions.

On the eleventh of March following, the City Council requested the Mayor to apply to the Legislature for an Act "authorizing the City Council of Boston to take by purchase or otherwise such quantity of land as may be necessary for the convenience of bringing soft water into the city by aqueduct, from such neighboring Town as may be hereafter determined, and to take all such other measures as the City Council shall judge requisite in the premises." Accordingly, Mayor Wells on the 19th of March, 1833, made application to the Legislature; but, as it was so late in the season, nothing could be done,— and, on the 21st, the petition was referred to the next General Court.

February 10th, 1834, the Mayor, Theodore Lyman, Jr., sent a communication to the City Council on the subject of the introduction of water, which was

referred to a Committee to report. They reported April 14th, when the following vote was passed. "That a Committee be appointed, with authority to cause a survey to be made by competent persons, for the purpose of ascertaining whether a steady and copious supply of pure and soft water can be obtained; and also what will be the best mode, and the cost of introducing such supply of water into the City; and that the said Committee report to the City Council the result of the survey as soon as completed."

According to the above vote, a Committee was chosen, the Mayor being the chairman, and on May 10th, 1834, they appointed Col. LOAMMI BALDWIN, to make an examination, survey and report upon the subject.

Col. Baldwin immediately commenced upon the work, and made his report to the Committee October 1st, 1834, which covers, including estimates and appendix, seventy-eight pages. (See City Document No 12, of that year.*)

This is one of the most complete reports on the subject of supplying a city with water, that can be found.

He says: "There are four methods by which water is usually procured by the citizens of populous towns. *First*, by collecting in cisterns, rain water falling on roofs of houses, etc. *Second*, by raising it from wells made in the common way. *Third*, by boring into the earth and tapping springs below. *Fourth*, by conducting it into town from high and distant sources, either by aqueduct, conduit pipes, or pumps. He then describes each mode; six pages being required for the account of Artesian or Bored Wells, and twenty-six pages for Aqueducts. In the latter he describes the aqueducts of ancient and modern Rome, giving the following table of the former.

| Name. | | Era. | Length. | Cubic feet per day. | Gallons per day. |
|---|---|---|---|---|---|
| 1. Appian Aqueduct | B. C. | 312 | 10.3250 | 3,706,575 | 27,724,181 |
| 2. Old Anio " | " | 273 | 36.6775 | 8,932,338 | 66,813,887 |
| 3. Marcian " | " | 146 | 56.9417 | 9,525,390 | 71,249,917 |
| 4. Tepulan " | " | 127 | 14.2341 | 903,795 | 6,760,386 |
| 5. Julian " | " | 35 | | 2,449,386 | 18,321,407 |
| 6. Virgin " | " | 22 | 14.3116 | 5,085,624 | 38,040,467 |
| 7. Alsietina " | A. D. | 14 | 20.4526 | 796,152 | 5,656,016 |
| 8. Claudian " | " | 49 | 42.1989 | 9,356,817 | 96,988,991 |
| 9. New Anio " | " | 90 | 54.1644 | 9,622,878 | 71,979,127 |
| Total, | | | 249.3058 | 50,378,955 | 379,834,379 |

* The City Documents are numbered each year from No. 1, upwards.

He describes also the aqueducts of Constantinople, Lyons and of London; giving the following table of the latter.

| Name. | Houses of Tenants. | Cubic feet per day. | Gallons per day. |
|---|---|---|---|
| 1. New River Company by Canal | 66,000 | 2,000,000 | 13,000,000 |
| 2. East London Water Works | 42,000 | 950,000 | 6,000,000 |
| 3. West Middlesex Water Works | 15,000 | 360,000 | 2,250,000 |
| 4. Chelsea " " | 12,400 | 282,000 | 1,760,000 |
| 5. Grand Junction " " | 7,700 | 450,000 | 2,800,000 |
| 6. Lambeth " " | 16,000 | 200,000 | 1,244,000 |
| 7. Vauxhall, South London Water Works | 10,000 | 160,000 | 1,000,000 |
| 8. Southwark " " | 7,000 | 115,000 | 720,000 |
| Total, | 176,100 | 4,517,000 | 28,774,000 |

Accounts of the Water Supplies of Edinburgh, Greenock, Glasgow, Paris, Beziers, Philadelphia, Cincinnati, and Richmond, follow.

He then comes to the subject of the supply of the City of Boston, and proceeds to the investigation of the means of supplying, or of bringing within the control of the city 5,000,000 gallons daily.

He states that there are many Ponds within the distance of about twenty miles, from which a supply of pure water may be had, by its natural flow to ground within four or five miles of Boston, sufficiently elevated to deliver water through pipes without the intervention of machinery, to the highest points of the city; and even to flow the floor of the State House.

Some of these Ponds have been examined, and put down in the following table.

| Name of Pond. | Town. | Area. A. Q. R. | Ft. above Marsh. | Distance. M. Q. R. | Estimated daily capacity in gallons. |
|---|---|---|---|---|---|
| 1. Spot Pond, | Stoneham | 260 | 143.58 | | 1,600,000 |
| 2. Waltham Pond, | Waltham | 52 0 51 | 192.67 | 11 3 35 | |
| 3. Sandy " | Lincoln | 152 1 24 | 222.95 | 16 3 26 | |
| 4. Baptist " | Newton | 33 2 24 | 137.46 | 9 3 40 | |
| 5. Punkapog " | Canton | 217 | 147.77 | 15 0 41 | |
| 6. Charles River, | Watert'n | | | | |
| 7. Massapog Pond, | Sharon | | | | |
| 8. Long " | Natick | 600 2 24 | 127.91 | 24 3 08 | 16,156,800 |
| 9. Farm " | Framingh'm | 193 | 149.37 | 26 2 60 | 555,794 |
| 10. Shakum " | " | 89 2 | 155.01 | 27 0 20 | |
| 11. Learnard's " | " | 36 | 158.32 | 27 1 70 | |
| 12. Dug " | Natick | 30 ? | 133.66 | 24 0 63 | |
| 13. Morse's " | Needham | 20 ? | 112.40 | 20 0 70 | |
| 14. Bullard's " | " | 35 | 104.45 | 19 0 07 | |

He then describes each pond separately, and adds: "From all the sources I have examined in the vicinity of Boston, as before stated, the most eligible are those of Farm and Shakum Ponds in Framingham, together with incidental ones dependent upon them; and Long Pond in Natick.

"The best mode of bringing the water to town is by an aqueduct, without the use of pipes, to the nearest point of sufficient height to allow it to flow through cast-iron pipes to the highest land in the city."

For this purpose, he proposes "to establish a Reservoir near the road leading from Roxbury to Brush Hill Turnpike; the Reservoir to be of such height that the surface of the water, when full, should be 110 feet above marsh level."

He then gives four plans for constructing an aqueduct. "*First*, an open canal or drain, like common navigable canals, but on a small scale. *Second*, to build stone walls four or five feet high, instead of leaving the sides of the aqueduct or canal of natural earth. *Third*, a drain with stone-walls, two or three feet apart, laid upon each side, without mortar or cement, three or four feet high, with flat stones to cover the top, and earth laid over the whole, so as effectually to conceal the work from sight, protect it from mischief and frost, and leave the ground free for ordinary use.

"The *Fourth*, is that furnished by ancient Roman works, and is like the third in form, but built in regular masonry, laid in hydraulic cement or in common mortar, and lined with cement. In this, the bottom should be stone, the top covered with the same, and the whole laid under ground, or where the foundation is too low, the work to be surrounded and covered with an embankment." The latter is the one that he recommends.

He then gives his idea of the route to be taken, with a description of each section, and the cost of the whole, which he estimates at $750,000, not including the distribution in the city, as that must depend on the quantity distributed.

If Long Pond should be adopted instead of Farm and Shakum Ponds, it will add, in his opinion, but $20,000 or $30,000 more.

Col. Baldwin has also annexed to his report the ANALYSIS made by DR. CHARLES T. JACKSON, of the water from the various ponds named, and also his own report on the capacity of Jamaica Pond, in which he states that "this pond could distribute ten times the quantity of water that had hitherto been used."

Mayor Lyman, in behalf of the committee, gave their report to the City Council, November 17th, together with that of Col. Baldwin above referred to, in which they say that the subject is of such vast importance, that

they recommend that it should be submitted to the people, and that the report of Col. Baldwin be printed for general distribution.

During the year 1834, there were three appropriations to meet the expenses incurred by the committee, viz: on April 14th, $2,000; November 17th, $2,000; and on December 8th, $2,000.

In the following year, August 17th, 1835, a Petition was presented by J. C. Warren and others, Physicians, praying that measures might be taken for supplying the city with wholesome water, which was referred to a committee, Mayor Lyman chairman, who reported a Resolution favorable to it, on October 13th; but no action was taken thereon.

January 4th, 1836, a committee was chosen, Mayor Samuel T. Armstrong chairman, to cause a survey to be made, and to take into consideration whether it be best for the City to bring the same in at its own expense, or for a private corporation, and to make report. (See City Document No. 7, of 1836.)

A Petition was presented January 18th, from Isaac Parker and 435 others, praying that water might be brought into the city, which was also referred to the same committee.

The committee, on the 14th of January, employed MR. ROBERT H. EDDY to survey Horn and other Ponds emptying into Mystic Pond; also Spy and Fresh Ponds in Cambridge; and on the 21st of April, requested him to report on the cost of the introduction of the waters of Spot and Mystic Ponds into the city.

On the 16th of April, 1836, was passed an Act of the Legislature, Edward Everett being Governor, incorporating William Sullivan, Daniel P. Parker, Caleb Eddy, and their associates and successors, by the name of the BOSTON HYDRAULIC COMPANY. This Act gave the company power to issue one thousand shares, and to assess the same, to an amount not exceeding one thousand dollars per share, and to take any ponds or lands covered with water situated northwardly of Charles River, and within twelve miles of Boston, for the purpose of conducting water therefrom through the town of Charlestown, in the county of Middlesex, and through the City of Boston. It gave full power for the erection of the works and maintaining the same; also gave the power to the City of Boston to subscribe for one-third part of the shares or any less proportion thereof. The City of Boston also had the right to purchase of the Corporation their franchise and all their personal and real property "by paying therefor such a sum as together with their receipts will reimburse the whole amount expended, with an interest of ten per cent per annum; and in the event of purchase, the city to take all the rights, and be subject to all the

duties of the Corporation, especially as to continuing the supply of water to the town of Charlestown."

The Act provided that if the work was not commenced within three years, or completed within six years, the Act should be void, and it would likewise be void, unless the City Council of the City of Boston should, within four months after its passage, declare by a vote their assent thereto.

Mr. Eddy made his Report to the Committee the 13th of June, covering twenty-six pages. (See City Document No. 12, of 1836.)

In it he says: "We should be very cautious in the choice of a project for the supply of water for many reasons. The consumption of water by the inhabitants of a large city is extremely slow after its introduction, many years elapsing before the quantity the works are capable of affording is thoroughly distributed. The income is in proportion to the quantity used.

"If the introduction is in proportion to the consumption, and at such a cost from time to time as to afford a good interest on the principal invested, the works must always continue to be productive. On the contrary, should we at the *commencement* invest a large amount of capital in works calculated to introduce *at once* a quantity sufficient for the consumption at a *future period*, when the city shall have increased greatly in size, but a small portion of this water is at first taken by the inhabitants, and, of course, the income being always in proportion to the consumption, much, if not a greater part of the capital invested, must be unproductive; and, in a short time, the simple or compound interest lost on the unproductive portion exceeds the capital itself, thus causing the actual cost of the works, (when the period of time shall arrive that the consumption shall equal their means of supply,) to exceed perhaps double or treble the first outlay, and always be an unproductive property.

"In point of purity, our fresh water lakes, fed by springs and mountain brooks, are infinitely superior to rivers, the latter being generally charged with detritus in a greater or less degree, while nature, in the former, has afforded the means which art takes to remove the impurities.

"These lakes are large settling Reservoirs of themselves, and the waters derived from them are of the purest nature. By the introduction of such, we are not subject to costly projects of filtration, or to the erection of large and expensive Reservoirs to remove the extraneous matter. Such being the fact, it becomes a highly important consideration, whether it is not cheaper in the end to expend at first a much greater sum to bring the waters of a pure lake into the city than would be necessary to introduce those of a river."

After making a few remarks in regard to Charles and Neponset Rivers, he says:

"Within a compass of thirty miles around Boston are many fresh water lakes, all at a sufficient altitude above the level of the sea to reach the highest land by the force of gravity; but as all these lakes have their outlets into either the Neponset, Charles or Concord Rivers, they act as feeders, and are among the principal sources from which these rivers derive their water. It is evident the greater the capacity, and the higher these lakes are above tide-water, the more valuable they become as tributaries to streams, on which are situated extensive mills and factories; and when it is known that in order to introduce five or six millions of gallons of water into the city (a supply for a future period), it would be necessary to take from any point, a quantity of water sufficient, with an ordinary fall of 16 feet, to operate a large cotton factory of four or five thousand spindles, the damage to works already built at different points on the several streams, into which the waste waters of these lakes flow, increases in the ratio above stated, and must, in many instances, be almost incalculable; and were the City Government authorized by an act of the Legislature to take a pond with these liabilities, the city would be involved in extensive and endless litigation and expense.

"The waters of the Ponds of Framingham and vicinity, known by the names of Farm, Shakum, and Long Ponds, empty into Concord River."

After naming a number of mills and factories below these sources, he says: "All of which would be more or less injured by the abstraction of these waters. The same objections apply to Punkapog Pond, emptying into the Neponset, which could only be brought into the city by iron pipes, which would be of such number and dimensions, as to exceed in expense a sum far beyond what the consumption would ever warrant."

He then goes into a calculation as to the cost of raising water by steam power, which he estimates at thirty-two cents per horse power, and says, "from these, and many other considerations I might enumerate, I am led to believe we can be supplied with an abundance of pure soft water, from resources within five miles, *in any quantity* which may ever be wanted, at a much less expenditure than from any other source within thirty miles of the city."

He gives a list of the Ponds surveyed and examined as follows:

| | | | |
|---|---|---|---|
| Spot Pond, | containing | 260 acres, | in Stoneham. |
| Horn Pond, | " | 102.83 " | in Woburn. |
| Wedge Pond, | " | 20.63 " | in Woburn. |
| Winter Pond, | " | 15.60 " | in Woburn. |

| | | | | |
|---|---|---|---|---|
| Little Pond (adjacent), | containing | 3.47 | acres, | in Woburn. |
| Mystic Pond, | " | 227.89 | " | in Medford. |
| Spy Pond, | " | 124.34 | " | West Cambridge. |
| Little Pond (adjacent), | " | 16.23 | " | West Cambridge. |
| Fresh Pond, | " | 180.57 | " | Cambridge. |

"By raising a dam where the Middlesex Canal crosses Mystic River, the whole of the ponds above enumerated might be united. But the results of the surveys and examinations have proved that the quantity of water in Mystic Pond alone is so great as never to render it necessary to resort to either of the others."

Of Spot Pond, he says, after giving his calculations: "I shall therefore feel safe in estimating this pond capable of supplying, on the average, from 2,500,000 to 3,000,000 gallons per day." Mystic Pond he estimates at 12,960,000 gallons per day.

"By an examination of a map of Boston, it will be found that about one-fifth of the city lies above a horizontal plane, twenty feet above the highest tides; and the remaining four-fifths or principal part of the city, is below this plane. The portion above I shall denominate, for the purpose of discrimination, *high service*, and the other *low service*.

"It is evident from the present density of buildings on the *high service*, that it can never increase to a much greater extent, and that all future increase in buildings and population must be in the portion termed *low service*."

His Report then gives an estimate of the cost of raising water for the high, and for the low service, and treats of the mode of introducing water from Spot and from Mystic Pond, with an estimate of cost of each, without the cost of pipes and other requisites for distribution. From Spot Pond he estimates the cost at $388,747.76. From Mystic Pond at $218,130.00. To which latter sum is to be added $175,200, as the expense of supplying 3,000,000 gallons a day by pumping, which would be required to supply the high service.

The 30th of June, the last named Committee made their Report. (City Document No. 7, for 1836.) A majority of the Committee were of the opinion, "That the city in its corporate capacity ought not to embark in this enterprise, but that it should be left to individuals alone, or to individuals in connection with the city." A minority were of a different opinion, "believing that so great and beneficial were the objects proposed, that the public welfare demanded *certainty* and *despatch* in the execution of the business."

The Committee finish their Report by recommending the adoption of the following Resolves:

"*Resolved*, That it is expedient for the City Council to give their assent to the Act of the Legislature passed on the 16th of April, 1836, incorporating the Boston Hydraulic Company.

"*Resolved*, That it is expedient for the city to subscribe for one-third of the stock in the Boston Hydraulic Company, under such restrictions and limitations as the City Council may hereafter prescribe.

"*Resolved*, That the printed copies of the Report of Mr. R. H. Eddy, be distributed as follows: to each member of the City Council, ten copies, and the remaining copies be placed at the disposal of the Mayor and Aldermen."

The first resolve passed with the following amendment to the first line: "That the assent of the City Council of the City of Boston be and is hereby given and declared to an act, etc." The second was rejected, and the third accepted.

July 25th, an appropriation of $4,000 was made to pay the expenses incurred by the committee for survey, etc.

August 16th, a Public Meeting upon the subject of the introduction of Water, was held in Faneuil Hall, at which the Mayor presided. After considerable discussion, Dr. J. B. Flint offered a series of Resolutions, which were referred to a Committee to report at an adjourned meeting to be held at the same place on the 22nd inst.

At the adjourned meeting on the 22d August, the following Resolutions were reported by the committee, and adopted by a vote of 2,107 to 136.

"*Resolved*, That it is right and expedient, for the City in its corporate capacity, with its own means and credit, to undertake and prosecute to a speedy consummation, the most favorable project, for the introduction and distribution of pure soft water, in sufficient quantity to answer all the domestic and public purposes for which it may be required.

"*Resolved*, That the object in view can only be obtained in an economical and satisfactory manner, by an establishment of a Board of Commissioners, who shall hold their office by a permanent tenure, and whose duty it shall be, to devise and execute the best mode of affecting said object, having reference to the quality and quantity of water to be obtained, and the expense to be incurred; to borrow, on the credit of the City, the funds required for the purpose; to collect the revenue which may accrue from the work, and appropriate the same to the extinction of the debt which shall be created; subject to such regulations and restrictions as the City Council shall impose, in the ordinance establishing said Board.

"*Resolved*, That it be recommended to the city authorities, to establish a BOARD of COMMISSIONERS, consisting of three able and discreet persons, who shall not be removed from office, except by a vote of at least two-thirds of each branch of the City Council.

"*Resolved*, That the City Council be requested to apply to the Legislature, at its next session, for the necessary authority to carry into effect the preceding resolutions."

These Resolutions were communicated to the City Council by the Mayor, September 5th, and were referred to a Committee, as was also the following MEMORIAL, concerning Jamaica Pond, presented to them August 20th.

"*To the Mayor and Aldermen of the City of Boston:*

"The MEMORIAL OF THE BOSTON AQUEDUCT CORPORATION respectfully represents that your Memorialists have, for many years, supplied a considerable portion of the city with pure and soft water; that, for the purpose of meeting the increased demands of the citizens, your memorialists have long since caused surveys and estimates to be made, by Loammi Baldwin, Esq., whose Report has been before the City Government; and by which it appears that an additional expenditure of money, and a more judicious and skilful employment of their present powers, will enable your memorialists to supply the city with "*ten times*" the quantity of water furnished at present, and at any point of elevation, when it may be reasonably required; that your memorialists have been restrained from the requisite extension of the works, and the necessary investment of money for that end, by an apprehension that the City Government, urged by a strong popular feeling, might, at some time, cease any longer to permit the provision of pure water to remain in the hands of private corporations, as in London, and elsewhere, where it is supposed, that, by the competition of such corporations, the public is likely to be the better served.

"In connection with the present exhibition of popular feeling and opinion on this subject, your memorialists have thought proper to state to the City Government, in a formal manner, their perfect willingness to extend their works agreeably to Mr. Baldwin's suggestion, upon any reasonable assurance, if such can consistently be given, that your memorialists will have no reason to fear any more formidable competition than that of a private corporation. On the other hand, should the City of Boston decide, that it will furnish a supply of pure water to the citizens, itself, your memorialists hereby tender their water works to the city, for a reasonable compensation.

"The books and records of the company are open for the examination of the City Government."

This was signed by the officers of the corporation.

December 19th, The Committee to whom were referred the Resolutions passed at the General Meeting before referred to, and also the Memorial of the Boston Aqueduct Corporation, made their Report in which they say, "That the powers necessary and indispensable to the attainment of the objects proposed in the Resolutions, can only be obtained from the Legislature of the Commonwealth, and as there has been no session of that body since their adoption, of course nothing has been done; but they recommend that these Resolutions be referred to the early attention of the next City Council."

Of the Memorial of the Boston Aqueduct Corporation, which was referred to them, they say: "That the utmost frankness and candor were manifested by the officers of this Corporation in all their interviews and correspondence with the committee." "That since the appointment of this committee, several successful efforts to obtain water of good quality and in much abundance have been made on the principle of Artesian wells, and from the success that has attended these efforts, they recommend that the expediency of making an experiment at the charge of the city, be referred to the next City Council." After alluding to the various sources relied upon as likely to afford a supply of water for the city, which they name as the Framingham Ponds, Spot Pond, Jamaica Pond, and wells on the Artesian principle, they say: that "the subject is of great importance, and it is their belief, that a vast majority of the inhabitants are in favor of the introduction of water; that they have done all in their power to facilitate the accomplishment of the object"; and they then recommend a reference of the whole subject to the next City Council.

# CHAPTER III.

## 1837.

First Standing Committee on Water chosen — Artesian Wells — Daniel Treadwell, James F. Baldwin, F. C. Lowell, and Nathan Hale, appointed Commissioners — Land for a Reservoir — Application to the Legislature for an Act — Rooms for Commissioners — Appointment of, and ordinance relating to, the Commissioners — Fourth appropriation made — Report of the Commissioners — James F. Baldwin's communication — Mayor Eliot's letter to Messrs. Treadwell and Hale — Their reply.

On January 16th, 1837, the first STANDING COMMITTEE ON WATER was chosen by the City Government; the Mayor, Samuel A. Eliot, being its chairman.

On the 23d of January, the Standing Committee on Water, were instructed to inquire into the expediency of constructing one or more Artesian wells and of the expense of the same; they were also "authorized to appoint three Commissioners to investigate, and report as to the means for a supply of water."

February 24th, the Standing Committee asked leave to purchase land for a reservoir at a cost not exceeding $150,000, which was granted; but no land was then purchased.

On the 27th of February, the Mayor was requested to make application to the Legislature, for an Act, to enable the city to obtain a supply within twelve miles of Boston.

On March 16th, the City Government passed the following Order, "that the power heretofore given to the Standing Committee on the introduction of water into the city, to remove at their pleasure such Commissioners as might be appointed on the subject of introducing a supply of water, for the use of the city be, and the same is hereby revoked. And that for the purpose of procuring for the use of the citizens a supply of pure water, three Commissioners shall be appointed, in the manner heretofore ordered by the City Council, who shall

hold their offices till removed by a concurrent vote of the City Council; and each of said Commissioners shall receive for his services at the rate of eight dollars a day, for all the time employed by him in inquiries, investigations, or calculations connected with the duties assigned to him, and also all necessary travelling expenses. And said Commissioners shall proceed forthwith to examine the source from which such supply can be obtained, and the best means of introducing and distributing the same, and make a detailed report to the City Council, through the Standing Committee on Water, of their proceedings, specifying the plan which they deem it expedient for the city to adopt, with particular estimates of the cost; and they shall appoint such Engineers, and Agents, and incur, on account of the city, all such expenses, as they may deem necessary for, or concerning the object of their appointment, under such appropriations as the City Council may see fit to make.

"And further, that whenever the plan shall be reported by said Commissioners, and be approved and adopted by the City Council, said Commissioners shall proceed to carry the same into execution, and for this purpose they shall, in the name and behalf of the city, make all contracts and bargains they may deem necessary, and they shall report their proceedings once every three months to the City Council, through the Standing Committee on Water; and their proceedings shall, at all times, be open to the examination of the Mayor and either branch of the City Government, or to a committee of either, authorized to make such examination.

"And they shall, from time to time, make representations to the City Council of the necessity for appropriations, and of the sums required for the regular continuance and successful completion of the work assigned to them."

This Order was passed by the City Council March 20th.

The Commissioners appointed under the Orders above named, were Messrs. Daniel Treadwell, James F. Baldwin and Francis C. Lowell: the latter resigned, and Nathan Hale was appointed.

May 1st, the Commissioners asked of the City Council an appropriation for expenses; this was referred to the Standing Committee on Water, who reported on the 29th that a sum not exceeding $10,000 be appropriated to meet the expenses; and an order to that effect was passed.

November 23d, the Commissioners made their Report, covering forty-five pages, — See No. 24 of City Document for 1837, — from which we make the following abstract: "Their first object was to determine the quantity of water required, in which they found considerable difficulty, on account of the uncertainty of the data for computing the average quantity of water required by each

family, as it varied according to the habits of the people in different cities, and also on account of the rapid increase, though at unequal rates, in the population of Boston.

"It is the common opinion among those who use wells and cisterns, that eighty gallons a day for each family are sufficient for all domestic uses, but where water works are established, it will be found that a larger quantity is used; thus, in London the average is one hundred and eighty-seven gallons to each tenant daily; in Philadelphia one hundred and sixty gallons; this includes, however, in both cases, the water used for watering streets, extinguishing fires, and for all other purposes. The London supply is equal to twenty-seven and three-quarters gallons, and the Philadelphia twenty-eight and one-half gallons, to each inhabitant, therefore to make the supply of Boston equal to that of London, according to its inhabitants, would require 2,220,000 gallons.

"The population of this city, now (A. D. 1837) 80,000, has doubled within the last twenty years; the last seven years, the increase has even been more rapid than any preceding period of the same duration. We may fairly anticipate that in five years from the present time, the population will be 87,000, which will require 2,500,000 gallons daily, and at the end of ten years, the population being taken at 105,000, will require 3,000,000 gallons daily.

"With these views, we have provided in our designs for an immediate supply of 1,600,000 gallons daily, to be extended in five years to 2,500,000, and at the end of ten years to 3,000,000 gallons daily."

Of Artesian wells, they say: "It does not appear important to us to enter upon the question of the possibility of obtaining 2,000,000 gallons of water daily, from any number of wells of this kind, because if it could be so obtained, even from so small a number as twenty of these wells, the difficulty and cost of raising and distributing it to the inhabitants, must be greater than that which will be incurred, by bringing purer water from any of the neighboring ponds or rivers, and distributing it by the same means to the citizens.

"The following table shows the sources examined:

| Names of Ponds & Rivers. | Situated in. | Acres in Area. | Feet above high water. | Miles from State House. |
|---|---|---|---|---|
| Spot | Stoneham | 283 | 143.01 | 8 |
| Reading | South Reading | 276 | about 50. | 12 |
| Horn & Wedge | Woburn | 123 | | 10 |
| Mystic | Medford | 228 | | 7 |
| Spy and Little | West Cambridge | 140 | | 6 |
| Fresh | Cambridge | 180 | | 5 |
| Waltham | Waltham | 52 | 189.67 | 11 |

| Names of Ponds & Rivers. | Situated in. | Acres in Area. | Feet above high water. | Miles from State House. |
|---|---|---|---|---|
| Sandy | Lincoln | 152 | 219.95 | 15 |
| Morse's | Needham | 20 | 109. | 15 |
| Ballard's | " | 35 | 101.64 | 15 |
| Long | Natick | 600 | 123.52 | 18 |
| Farm | Framingham | 193 | 144.98 | 21 |
| Shakum | " | 89 | 150.62 | 22 |
| Farm | Sherburne | 160 | | 19 |
| Baptist | Newton | 33 | 138.99 | 9 |
| Punkapog | Canton | 217 | 144.77 | 13 |
| Massapog | Sharon | | | 22 |
| Great Pond | Weymouth | | | 20 |
| Charles River | | | | |
| Neponset River | | | | |

"Of the above, Spy Pond, Waltham Pond, Sandy Pond, Morse's Pond, Ballard's Pond, Farm Pond in Framingham, Shakum Pond, Farm Pond in Sherburne, and Baptist Pond, were at once considered insufficient for a supply; while Massapog Pond is too distant, compared with other sources; and Reading Pond on account of its distance, combined with want of elevation, also Weymouth Great Pond, on account of its distance and the dark color of its water, were set aside; and upon further examination, all were rejected except SPOT POND, LONG POND, MYSTIC POND, and CHARLES RIVER. The first two being preferable to all others as not requiring elevation by artificial means, and the last two as preferable to all others, if such means are to be resorted to."

They then describe each separately, giving the estimated DISCHARGE, on an average, per day, as follows: Spot Pond, 2,100,000 gallons, and from Long Pond 8,743,680 gallons.

They also give Dr. A. A. Hayes' ANALYSES of the water from the several ponds and rivers; the most transparent being Spot Pond; second, Long Pond; third, Mystic Pond; fourth, Charles River. There was no marked difference in taste, all being nearly insipid.

They give the ROUTE and manner of CONSTRUCTION of each of FOUR PLANS, with detailed estimates of the COST of each, which they make as follows, including distribution.

| | | |
|---|---|---|
| First Plan | Charles River, | $1,428,872 |
| Second Plan | Mystic Pond, | 1,527,414 |
| Third Plan | Spot and Mystic Ponds, | 1,507,560 |
| Fourth Plan | Long Pond, | 1,775,848 |

They then say: "As the second plan is certainly not superior to the third, and as the execution will require a greater expense than the third, we are of opinion that it ought not to be adopted. By adopting the first plan in preference to the third, a saving of $80,000 would be effected, but as the constancy of the supply in this plan depends upon the operation of machinery, which always implies some shade of uncertainty, and taking into consideration the better quality of the waters of Spot and Mystic Ponds, we are of the opinion that the first plan, founded on Charles River as a source, ought not to be adopted."

In comparing the two remaining sources with each other, they estimate "That the Long Pond plan will cost $268,288 more than that of Spot and Mystic Ponds; the quantity of water brought into the city, by the works provided in either plan, for the first ten years being nearly the same. To this should be added the interest at five per cent, on the excess of cost, and the expense of a new main that would be required to obtain additional supply; which will make the total cost to the city $626,159. From which should be deducted the expense of increasing the supply from Spot and Mystic Ponds, which they estimate at $508,857, making a difference at the end of 20 years, in favor of the Third, or Spot and Mystic Pond Plan, of $117,302."

On a full review of this comparison, a majority of the Commissioners are of opinion "That it will be expedient for the city to adopt the Third plan herein proposed."

Mr. James F. Baldwin, the other commissioner, likewise sent at the same time a communication to the committee, in which he gives his objections to the plan proposed by Messrs. Treadwell and Hale.

In the first place, he "objects to the plan of pumping up water, in whole or in part, for the supply of the city, as it would entail forever on the city the care, trouble and expense of maintaining this power, and of supporting perpetually an establishment for carrying on its operations. Another reason for rejecting this mode of raising water is the necessity the city will always be under, of maintaining the fires, which must never go out, by sea-borne coal, a supply of which may be interrupted or entirely cut off by the act of our own government, or the interference of foreign powers; and that in seasons of scarcity, in providing for the wants of this establishment, burdens may be imposed on the citizens, by enhancing the price of such fuel as may be necessary for their ordinary consumption. He also objects to Mystic Pond as a source of supply, as the pond lies below the level of high tide; the tides now flow into and out of the pond; and a dam across the outlet must be erected, to shut out the tide waters, and retain the fresh. The effect of building such

a dam, will be in my opinion, to fill up, in some degree, the channel of the river, and produce serious consequences to the inhabitants of Medford; who would, I think, successfully resist any application, made by the Legislature, for authority to establish it." He also objects to the color and character of the water which composes this source.

In regard to the excess of cost he says "What are ten or eleven years, or what are $117,000, in a work of this description? Population is increasing, and will continue to increase whether the work goes on now or not; and if we go on in this piece-meal way, we shall ever be at work, and never fully satisfy the wants of the citizens." He concludes his Report in the language of one of the Directors of the Fairmount Water Works of Philadelphia; "*If you can get water without pumping it, I advise you to do it.*"

December 1st, Mayor Eliot sent the following note to Messrs. Treadwell and Hale:

"Gentlemen,

Mr. Baldwin, who has been associated with you in the Commission on the Introduction of Water, has sent me some objections to the plan approved by you. As I see no particular reference to these objections in the Report, I send you the communication that you may have an opportunity to present to the City Council any remarks that you may think it expedient to make.

Respectfully, your ob't serv't,

(Signed) SAM'L A. ELIOT."

On the 8th of December, Messrs. Treadwell and Hale made their Reply, in which they state, "That as to the first objection of Mr. Baldwin, in regard to pumping, and the expense and care it would require if this mode of supply was adopted, they estimate the expense would not exceed $2,000 a year. Mr. Baldwin's objection, therefore, goes only to one of the items of cost in the plan recommended by them, which, after having been fairly discussed, and appraised in the report, was found to be of inconsiderable weight." Their answer to the next objection, of the necessity of providing a supply of fuel, is the same as the last, which is, "that, according to their best judgment, it weighs just $1,790 a year, and to this extent it is to be taken against the plan recommended, but no farther." The next objection of Mr. Baldwin, that the city would be under the necessity of maintaining fires that must never go out, they say, "that during the first ten years, it is shown that the engine will be required to raise 390,000 gallons of water a day, or 142,350,000 gallons a

year." The report and estimate expressly state that the engine is calculated to raise 2,500,000 gallons in 20 hours, or 1,095,000,000 gallons a year. If therefore it is kept at work 1,138 hours, or 48 days in any part of a year, the supply will be maintained. It is not true then, that the fires must be always maintained, unless "always" be taken as equivalent to one-seventh part of the time. Of the next objection, being obliged to use sea-borne coal, and the difficulties that might arise therefrom, they say: "They did calculate that the engines would be kept in operation by the use of coal, but that Mr. Baldwin well knows that steam may be formed by the heat of a wood fire, as effectually as by that of coal; and as to the advance of the price of coal occasioned by the extent of our demand in the market, they refer to the coal merchants to decide how much the price is affected, by an extra demand of 1 or 200 chaldrons a year."

Of Mr. Baldwin's objection to Mystic Pond, as being below the level of high tides, and thus requiring a dam to be erected, and of the effect of building such a dam, they say: "We look in vain through the foregoing statement for anything which affects the quality of the water of Mystic Pond, or the security, cost, or abundance of supply. In regard to the construction of a dam, they say: "That as the Legislature specially granted in the year 1836 to the Boston Hydraulic Company the right to build dams at the outlet of any pond within twelve miles of the city, and that company has never taken possession of these rights, surely the Legislature will not now deny to the City of Boston, the same privileges which were then granted to a private company."

As to the color and character of the water, they say: "We need not repeat that the analysis shows the water to be more pure than that of Long Pond."

They state: "The difference in cost, being $268,288, in our opinion deserved, and it received our attention, and had its due influence upon us, though by no means paramount, or indeed equal to that produced by our greater confidence that the supply by the plan recommended, will not be subject to interruption by any event which seems to us in the least degree likely to happen." (City Documents on subject of Water for the year 1837, Nos. 1. 9, 24.)

# CHAPTER IV.

## 1838.

Mayor Eliot's Address — Instructions to the Committee on Water, and their Report — L. M. Sargent's Reply to questions proposed to him — Petitions for and against the introduction of Water — R. H. Eddy's communication — Resolutions passed by the City Council — Vote of the citizens — Application to the Legislature for an Act — Report of the Committee on Water — Revised estimates of the Commissioners.

Mayor Eliot, in his Inaugural Address to the City Council on January 1st, 1838, says: "Of the subjects which will require the action of the City Council the present year, the introduction of an abundant supply of water is the most interesting and important. Every year adds to its importance, as every year diminishes the number and value of the available resources of the city within its limits.

"Springs fail, or the water from them becomes impure; and the supply of rain water is more and more affected by the increased consumption of bituminous coal, and other causes of impurity. The appointment by the last Council, of Commissioners, men of science and practical skill, to examine all sources of supply, and to recommend such a plan as appeared to them most expedient, at such a cost as they might think within practicable limits, has resulted in the presenting of an interesting and elaborate Report, which goes over the whole ground, and will enable the City Council to determine on the expediency of commencing the work, and to decide on the best of the numerous sources of supply. Important progress has thus been made towards bringing the lengthened discussion on this subject to a close.

"No previous report has been so comprehensive, nor has any plan been heretofore recommended by stronger argument or higher authority. I esteem it of much importance to the best interests of the city, that this work should be speedily commenced and vigorously prosecuted. A sufficient supply of good water is indispensable to the existence of any city; and if the experience of a few years past is any guide to what may be expected in the future, it will not

be long before the supply derived from wells within the city will be inadequate to meet the necessities of the inhabitants. Before that time arrives, it appears to me the obvious dictate of common prudence, to provide the means of supplying the deficiency. The expense of the operation is usually regarded as the great objection to it, but I entertain no doubt that the interest of the money nvested in the necessary works, and the cost of all repairs, would be repaid to the city by those who would use the water.

"A private corporation has, for several years, been ready to undertake the work, on their own account, if they could obtain permission. This permission, the City has never been willing to give; and it would be no more than justice to the large number of inhabitants who desire it, to try an experiment, which there is so much reason to believe would be crowned with success, and the neglect of which, may cause so much injury to the welfare of the community. The enhanced value of the city property, consisting of lands so situated that it is difficult to obtain water, which would be the consequence of abundant supply, would probably do much towards repaying the cost; while the additional security from fire, and the increased comfort and health of every individual inhabitant, seem to leave no motive wanting for undertaking the enterprise."

On the 5th of January, the Standing Committee on Water were instructed to ascertain if it would be necessary to apply to the Legislature for power to construct works on either plan proposed by the Commissioners; whose Report was also referred to said committee, with instructions to have 7,500 copies printed and distributed among the inhabitants.

On the 29th of the same month, the Water Committee made a long Report, recommending Spot and Mystic Ponds as the best source for a supply; and that it would be necessary to apply to the Legislature for power to construct the works; but no action was taken thereon.

One of the committee wrote to Mr. L. M. Sargent, a Director of the Boston Aqueduct Corporation, on February 16th, asking him several questions, to which he replied on the 21st inst., as follows: "That the Boston Aqueduct Corporation was incorporated A. D., 1795. That its capital, as far as can be ascertained is $130,000, divided into 100 shares. That the present market value is from $500 to $600 per share, perhaps less. That there was no dividend for the first ten years. That the average dividend for the next thirty years, was a fraction less than four per centum per annum, on the par value of $1,300. That the corporation now supplies between 1,400 and 1,500 houses. That according to their best judgment they supply on an average about one

dwelling house in every four within its range. Mr. Sargent then reviews at some length the report of the Commissioners.

March 1st, Mr. J. T. Austin submitted to the Common Council extracts from the minutes of evidence taken and papers laid before the select committee of the House of Commons, and the Commissioners on the supply of water to the city of London, England, in the years 1821, 1828, and 1834, covering twelve pages. These, with the above mentioned letter of Mr. Sargent, were ordered to be printed for the use of the council, and were afterwards referred to the Committee on Water; but as nothing applicable to the present works is contained therein, we make no extracts therefrom. (See City Water Document No. 9, of the year 1838.)

At this time, it seemed as if the entire population of Boston was aroused on the subject.

To give some idea of the public feeling, we annex the following PETITIONS sent to the Common Council, March 1st, 1838:

## PETITIONS IN FAVOR OF THE INTRODUCTION.

### No. 1.

*To the Honorable the City Council of the City of Boston,* —

The undersigned, inhabitants of the city, respectfully represent, That in their opinion such is the scarcity of pure fresh water in Boston, and the pressing demand for it in every part of the city, that it is highly expedient for the city to begin and complete upon its own account the necessary works for the introduction of a supply from some one or more of the sources in the vicinity, as soon as the necessary powers can be obtained from the Legislature.

The fact that there is in our city a great scarcity of this most important necessary of life, your memorialists did not believe admitted of a single doubt; nor did they believe, after so much has been said by scientific and medical gentlemen upon this long agitated subject, and after so many complaints as have been and are constantly being made about the scarcity of water, and the impurity of that now in use, that there could be a doubt in the mind of any person, at all conversant with the matter, that the health, comfort and convenience of the citizens generally, would be greatly promoted by the introduction of an abundant supply of pure water; and it is therefore with a great deal of surprise that your memorialists have learned that a proposition for bringing about this much desired object, after having passed one branch of the City Government by a large majority, is violently opposed by many members of the other branch; and that the princi-

pal arguments made use of by these opponents are, that there is already a sufficient quantity of pure water in the city, and consequently an additional supply from an external source, is wholly unnecessary, either for the present or future use of the inhabitants; and that the inhabitants generally, either do not want to see the project carried into effect, or take no interest in it whatever, because they have not flooded the City Council with their petitions in its favor.

Now the undersigned, with all due deference to the gentlemen who make use of such arguments, beg leave to differ from them in opinion; they think in regard to the first position assumed by them, "that there is now such an abundance of water that no more is needed," is but mere assertion, unsupported by the facts of the case, and that an inquiry upon this point among the citizens generally, or among the inhabitants of any particular ward, would convince gentlemen entertaining such opinions that they are founded in error.

With regard to the second position, "that the citizens do not approve of or take any interest in the project, because they do not petition in favor of it," your memorialists have only to observe that they had believed such an enterprise as that of supplying the city with pure water would be so manifestly for the good of the whole people of the city that no member of the City Government would think of opposing it, and that after the subject was once fairly before the Council, it would be brought to a successful termination at once. It is a fact, known to the citizens generally, that this subject has been directly before the City Council for three or four weeks, and that already more than a fortnight has elapsed since it was acted upon and passed with great unanimity by one Branch of the Government, and yet no remonstrances have been sent in against it.

This fact, in the opinion of the undersigned, is worthy of much consideration. It shows most clearly, that there is little or no opposition to the measure on the part of the citizens, and denotes more strongly the feeling of the community in regard to it than does the absence of petitions.

In conclusion, the undersigned beg leave again to express it as their unqualified opinion, that the public good requires the introduction of a supply of pure water into the city as soon as the proper works can be constructed; and without going into the question as to the source of this supply, but leaving that to the discretion and best judgment of the City Council, they trust that these works will be commenced and completed with all possible despatch.

Boston, February 1838. SIGNED BY 226 PERSONS.

PETITION NO. 2.

The undersigned, citizens of Boston, respectfully petition The City Council, to adopt such measures, as in their wisdom shall be found expedient for the immediate supply of good and wholesome water to every portion of the city.

SIGNED BY 243 PERSONS.

PETITION No. 3.

*To the Honorable the City Council of the City of Boston:*

The undersigned beg leave to express the following opinions on the introduction of pure water into the City for general use.

1. Convenience, security, cleanliness, health, and the pleasure of existence, will be more promoted by accomplishing this object, than by any other thing which can be done by the exercise of the power conferred by the citizens on the Council.

2. That it is *a good*, desirable for all alike, and will be especially a blessing to those who cannot have pure water, without the same be brought in by the city authority.

3. That actual examination by competent men, has proved the practicability of bringing in water, and that nothing is needed but the exertion of the Public Officers of the city.

4. That the expense of accomplishing the object cannot be an objection, because the money necessary may be borrowed, and the product of the investment would not only pay the interest, but maintain the works, and provide a fund to discharge the debt.

Lastly. *Let the thing be done*, and done as soon as by any exertion consistent with prudence and reasonable economy, is practicable.

SIGNED BY 141 PERSONS.

Boston, February 24th, 1838.

PETITION No. 4.

*To the City Council of Boston:*

The undersigned, inhabitants principally of Wards 11 and 12, feeling daily the want of pure water in their families and workshops, respectfully request of your honorable body, that immediate measures be taken by the City Government to introduce that invaluable article.

SIGNED BY 120 PERSONS.

Boston, February 1838.

## PETITIONS AGAINST THE INTRODUCTION.

PETITION No. 5.

*To the Honorable the Mayor and Aldermen and Common Council of the City of Boston:*

The Memorial of the subscribers, inhabitants and tax-payers of said city, humbly represents that they are alarmed at the prospect of having the debt of the city increased in a two or three-fold ratio, for the purpose of supplying the city with water, and this too before any measures are taken to ascertain how many families and others will take the same, and pay annually for the use of it, — as your memorialists doubt the willingness of citizens to incur the expense of relinquishing

their present good supply of well and aqueduct water with which use has long made them familiar.

The Honorable Mayor stated in his late Inaugural Address, "That a private corporation has for several years been ready to undertake the work on their own account, if they could obtain permission," your memorialists therefore would more deeply deprecate the passage of any act whereby the City should engage to accomplish this work in their corporate capacity, believing that a private corporation could perform it with much less expense. The present time does not, in the opinion of your memorialists, appear to be a suitable one to increase the taxes or debt of the city; this is a time of great commercial distress. If the debt of the city is increased two or three millions of dollars, the interest at least must be paid, and that added to the annual expenses of the city without any additional income absolutely known to exist to meet it, will double the present heavy taxes, thereby creating a burthen on the citizens, which, under present circumstances, they are ill able to bear.

For these reasons, your memorialists pray that the project of bringing an additional supply of water into the city may be granted to that "private corporation," which "has for several years been ready to undertake the work;" or that the City Council will, before any further steps are taken in this extensive undertaking, cause an accurate inquiry to be made throughout the city, and ascertain the names of all the citizens who are ready and willing to pay annually for the use of the water, at such rates as the City Council, in their wisdom, may believe it can be afforded.

And in duty bound, will ever pray.

SIGNED BY 164 PERSONS.

Boston, February 24, 1838.

PETITION NO. 6.

*To the Honorable the Common Council of the City of Boston*

The subscribers, Citizens of Boston, do respectfully represent, that our community have been reduced by circumstances beyond their control from a state of proud prosperity to a condition verging upon ruin.

All property is greatly reduced in value; our moneyed institutions and public confidence are paralyzed; much of our floating taxable property lost; enterprise and occupation suspended; and with no prospect of an immediate change for the better. Under these adverse circumstances, it appears to us that no new project, involving an increase of the city debt, and an increase of taxation, ought to be sustained. Therefore they humbly pray that you will restrict the expenses of our city to such objects as may appear to be necessary, for the good government and health thereof, and in particular, that you will defer all action upon the project for introducing fresh water into the city, from neighboring ponds, until more prosperous times. We feel that we ought to deny ourselves this luxury in common

with many others, until our means will afford their use; we are now in a diseased condition and unable to bear an additional burthen; but restore us to health and prosperity, and we will again jog on with such burden as you may please to load us.

SIGNED BY 135 PERSONS.

PETITION No. 7.

*To the Honorable Mayor, Aldermen and Common Council of the City of Boston:*

The undersigned having learned that the City Government intend incurring a debt of some millions of dollars, with a view of bringing water into the city, for the purpose of supplying the inhabitants therewith, would respectfully suggest to your Honorable bodies, whether it would not be a prudential step, first, to ascertain who of our citizens want, and will pay for the water, before the same is introduced and the debt contracted.

Your memorialists, who have hereunto set their names, respectfully ask that the project may for the present be suspended, until more information may be obtained as to who wants and who will pay.

SIGNED BY 54 PERSONS.

PETITION No. 8.

This Petition was the same in form as the one before, numbered six. IT WAS SIGNED BY 168 PERSONS.

The four petitions, in favor of the undertaking, contain the names of 723, and the four in opposition, 521 persons, all citizens of Boston, representing every class of society.

March 1st, a communication covering twenty-eight pages, was received from R. H. Eddy, Civil Engineer, addressed to Samuel A. Eliot, Mayor, chairman of the Committee on Water, from which we make the following extracts.

He says: "The generality of persons seem either to have lost sight of, or to have overlooked the expense of raising water by steam power. I presume they have assumed for their standard of comparison, the old works at Fairmount, Philadelphia, where engines and boilers ill adapted to the purpose were used, consuming immense quantities of fuel.

"As well might we base our calculation of the effective power of a locomotive engine and railroad at the present day on the performances of the same machine twenty years ago.

"Disagreeing entirely with Mr. Baldwin, as to the cost and propriety of a supply from the sources he recommended, I mentioned my views to your predecessor, and several gentlemen of the Water Committee of 1835. The

conversations with them resulted in the Survey and Report which were made by me for the City Government.

"The ideas of combining Spot and Mystic Ponds; of using the former for the *high service forever*, and also for both *high and low*, until such time as it might be requisite to employ the latter for the low service, were original with me. According to my plan, the water was to be forced into a reservoir on Bunker Hill, sixty feet above high tide; of course at about *one-half the expenditure* of fuel required to raise the same one hundred and twenty feet.

"The coal used could be delivered at the mouth of the furnace from the vessel without any expense of transportation to a distance from the wharf." Mr. E. says that the only plausible objection offered against his project, consisted in the mode of passing Charles River, near Warren Bridge; since that report was made, he had originated the idea of a 'tunnel under the bed of the river,' which he is satisfied might be done for about $60,000.

After giving some particulars in regard to the great tunnel under the Thames River, London, England, he compares the strata of the two, "which *will give double the thickness of clay above this excavation, only nine feet wide, that there is over the top of the arch of the Thames Tunnel, where the excavation is thirty-eight feet wide*;" and after describing the manner of its construction, he says: "*It will at once be evident that it is in point of magnitude and cost no Thames Tunnel affair, but perfectly feasible and of simple construction.*" "By taking the shortest route through Charlestown, and through the tunnel, a distance of two and a quarter miles will be saved over the Mill Dam route formerly proposed, which will make a clear saving of $ 83,709.50, at the first outlay;" he also estimates that he could save in the size of pipe by the short route, $ 35,130 more. After giving full particulars as to the manner in which the work should be done, with the estimates and savings on each division, he says: "That the whole sum which the city would gain at the expiration of ten years, by adopting the routes and conduits from Spot and Mystic Ponds through Charlestown, in manner proposed by him, over the routes recommended by the Commissioners, would be $ 604,700,59."

He closes thus: "In making this communication, I have been solely actuated by a desire to place the subject in a true light before the Water Committee."

On the 15th of March, 1838, Mr. Shattuck of the Common Council, offered the following Resolutions, which passed both branches of the City Government:

"Resolved, That the plan for supplying the City of Boston with a sufficient quantity of pure and wholesome water, for the use of the inhabitants, from Long Pond, as described by the Water Commissioners, in their report of November 23, 1837, be and the same is hereby approved, subject however to such variation in the mode of constructing the conduit as may be determined upon.

"*Resolved*, That it is expedient for the City Council to make application to the Legislature for an Act, authorizing the City of Boston, for the purpose of executing the plan proposed in the foregoing resolution, to take possession of any ponds, water rights, or land, in the county of Middlesex; to borrow money, and create such a City debt as will be necessary to pay the cost of said work; to tax the consumers and inhabitants for the annual interest and expenses attending the same; to create a sinking fund for the final redemption of the said debt; and for such other powers and restrictions as may be thought expedient to carry forward and complete this great work; and also providing for the acceptance of said act by the citizens, as specified in the following resolves.

"*Resolved*, That after said act is obtained, it shall be printed and furnished to all the legal voters of the city, accompanied with a statement, prepared and approved by the City Council after the most careful investigation, containing a detailed account of the plan by which the water is to be furnished, the estimated cost of the same; how the money is to be raised to pay for it, and also how it is proposed to pay the annual interest and expenses of the same, and how the debt is finally to be extinguished; and containing, also, questions embracing the foregoing propositions to be submitted to the legal voters; to the end that the said legal voters may express their assent or refusal to the said act and to the plan proposed, and also to allow the City Council to proceed in raising the money necessary to construct said works, by depositing their ballots in their respective wards in the same manner as at the municipal elections, at such time as shall be agreed upon and proposed to them by the City Council.

"*Resolved*, That after said poll is closed, if it shall appear that two-thirds of the whole number of votes given in, are in favor of said act and plan and of authorizing the raising of the said money, thereby conforming to the sixth joint rule of the City Council, requiring, in creating a City debt, 'that two-thirds of each branch of the City Council shall vote in the affirmative,' then the City Council shall proceed forthwith in the construction of said work."

March 19th, the Committee on Finance were ordered to report a plan "for a Sinking Fund for the payment of any debt that might be incurred by the intro-

duction of water; also that the calculations of the Commissioners be revised, to ascertain if there be any errors therein, and also to report what measures may be necessary to prevent the water introduced from being made free previous to the liquidation of the debt so incurred."

The Citizens assembled at their various ward rooms on April 2d, to vote on the following propositions:

First. Is it expedient for the City to procure a supply of soft water, at its own expense? The vote on this was, — yeas, 2,541; nays, 1,621.

Second. Is it expedient to begin the work the present year, if the necessary power can be obtained of the Legislature? The vote on this was, — yeas, 2,507; nays, 1,652.

On April 6th, the Committee were instructed to make immediate application to the Legislature for the grant of such power to the City as may be necessary for the introduction of water from Spot and Mystic Ponds or Long Pond.

October 15th, the Committee were instructed to consider the expediency of offering a bonus to a private corporation.

On October 26th, the Mayor again petitioned the Legislature for an Act, as requested by the vote of April 6th, which was referred to a Committee of the Legislature, who did not report until the following year.

The subject referred to the Standing Committee on Water, October 15th, was reported on by them December 20th. They state that they "are still of the opinion the City ought to construct the works, as there are many advantages which can be obtained by the city in the construction of such works, which cannot be made up to individuals, or to a private corporation, without the payment of what might reasonably be considered an exorbitant bonus.

"For instance, the City can ordinarily obtain money at a much lower rate of interest than individuals. Then the public uses to which the water may be applied, such as cleansing the streets, extinguishing fires, supply to public buildings, etc., are of high importance to the City in its corporate capacity, but of none at all to individuals. As long, therefore, as there is any reason to hope that the City will undertake the work, the Committee are of the opinion that it is inexpedient to offer any bonus to a private corporation."

They add, however, that if the City cannot be induced to commence this noble work, then it would be desirable that it should be done by others, rather than not at all.

They also submit, in connection with their report, the revised estimates of the majority of the Board of Commissioners, according to instructions given them by the order of the City Council, passed March 19th.

The revised Report of the Commissioners, above referred to, covering thirty-five pages, was submitted to the Committee December 15th, Messrs. Treadwell and Hale still adhering to their preference for Spot and Mystic Ponds, and Mr. Baldwin to his preference for Long Pond. No new facts are given, and their revised estimates are for Spot and Mystic Ponds $1,462,100, being $45,460 less than their former estimate, and for Long Pond $1,682,778, being $93,070 less. (City Documents on the subject of Water for year 1838, Nos. 1, 4, 9, 33.)

# CHAPTER V.

## 1839 TO 1845.

Mayor Eliot's Address — Committee on Water chosen — Col. Baldwin's objections to the Report of Messrs. Treadwell and Hale — Act reported by the Committee of the Legislature, and recommitted — Hearing upon the same — Resolve passed by the Legislature — Report of Committee on Water — Actions taken on the Resolve — Consumption of Water — Mayor Chapman's Address — Memorial of Charles Crocker — Petition of James C. Odiorne and others to bring Water from Spot Pond — Petition of Thomas A. Dexter and others, for the city to subscribe one-third of the stock in the Spot Pond Aqueduct Company — Petition of Walter Channing and others, for a Meeting in Faneuil Hall — Resolve of the Board of Aldermen — Meetings in Faneuil Hall — Appointment of P. T. Jackson, Nathan Hale and James F. Baldwin as Commissioners — Petition of Charles Crocker and J. M. Dearborn — Report of the Commissioners — Resolutions passed — Vote of the citizens on the Resolutions — Documents circulated.

ON the 7th of January, 1839, Mayor Eliot, in his Annual Address to the City Council, after speaking of the number of works that should be undertaken, says: "The first of these works, as well in importance as in the length of time it has been under examination and discussion, is that by which a supply of soft water may be brought from the vicinity into the city. On this topic, I can add nothing to what I have said on former occasions. I have uniformly expressed the opinion, that it is now the interest of the city, and will soon become a matter of necessity, to introduce such a supply of water. The sources from which a sufficient quantity can be obtained are well known, and have been thoroughly examined by skilful engineers; and although the Commissioners appointed by the City Government have not agreed in opinion as to which of the two sources is the *best*, yet they have satisfactorily demonstrated that either of the two is not merely sufficient, but of remarkably fine quality.

"The question before the City Council is one on which any person of practical judgment is competent to decide,—a question of expense merely. If it is determined that it is expedient to introduce water, it cannot be deemed a

proof of wisdom to hesitate long in the choice between two means of supply, of which either is unexceptionable. My efforts have been constant to promote the progress of an enterprise which I deem so important for the true and permanent welfare of the city, and no future exertions will be spared on my part, to hasten the moment when the work shall be begun.

"It must be obvious, however, that till both branches of the City Council have formed a decisive opinion favorable to the project, no individual efforts can be successful.

"The appropriation of money is necessary, and that must be done by those who control that branch of the public service. The City Government of the last year directed me to make application to the Legislature for the grant to the city of the powers necessary to bring the water from either of the two sources recommended by the Commissioners. As the order was passed, however, near the close of the session of the Legislature, no action was had on the petition, which was immediately presented; and I have taken the course prescribed in the Revised Statutes, for bringing it to the early attention of the Legislature during their present session, by publishing the petition in the newspapers, and serving notice on all the towns interested in the subject."

January 14th, the Standing Committee on Water was chosen, and that part of the Mayor's Address above mentioned was referred to them, together with all the documents of the last year relating to a supply of water. The Mayor was requested to write to Col. Baldwin, asking for his reason for objecting to the Report of Messrs. Treadwell and Hale, which he did on the 16th inst., and Col. Baldwin replied on the 22d, (City Document No. 5, of 1839,) giving his objections; but as they do not differ essentially from those given by him November 23d, 1837, which have been already mentioned, no extracts are made therefrom.

January 17th, a Bill was reported by the Committee of the Legislature, which was satisfactory to the city, but remonstrances having been presented to the Legislature by several Towns, the Middlesex Canal Co., and sundry citizens of Boston, against the project of the city, the Bill was recommitted with instructions to give the parties a hearing.

The hearing took place on the 24th and 30th of January, 1st, 6th, 27th, and 28th of February, and the 1st, 5th, 6th, 7th and 14th of March, on the part of the remonstrants; and on the 15th, 18th, 21st, 22d and 25th of March, on the part of the petitioners. At the last meeting the chairman stated that the time was so short before the Legislature would adjourn, that they should recommend a reference of the subject to the next session.

A report to this effect was accordingly made to the Senate, which, on April

4th, was recommitted with instructions to report a Bill; and on the discussion which arose upon the Bill, they were directed to bring in a resolve for the appointment by the Governor, of Commissioners to examine the whole subject. They reported the following Resolve, which was passed April 9th. (City Document No. 29.)

"*Resolved*, That the Governor of the Commonwealth, with the advice of the Council, is hereby authorized, on the application of the City of Boston, to appoint three Commissioners, who shall, at the expense of said city, after having given such notice to all parties interested as they shall think reasonable, ascertain and report to the next General Court all the facts and information which they may deem material in relation to the several plans proposed by said city for the introduction of soft water into Boston, and the bearing of the same upon the interests of all persons and corporations which may be effected thereby."

At the hearings above referred to, forty-five witnesses were examined in opposition to, and fourteen in favor of the measure; of the latter, seven were Physicians.

The Committee on the introduction of water, in their Report to the City Council, April 29th, covering nineteen pages (see City Documents 19 and 25), say: "It would be difficult to find on the records of any Legislature, a more remarkable result of a three months' investigation of a subject which, for several years, had occupied the attention of an important portion of the community. Indeed, the whole course of the branch of inquiry affecting the city was, in many respects, striking and novel. The action of the City by its own representative government, and by its corporate votes, was held of little or no account," and they close their report by saying: "But however desirous the committee may be to see a beginning of the important work of supplying the city with soft water, they do not think it expedient for the city to act under the resolve of April 9th, thinking it better to pursue the usual course of applying directly to the Legislature at the earliest opportunity; they therefore recommend the passage of the following resolve:

"*Resolved*, That it is inexpedient for the city to apply to the executive of the Commonwealth for the appointment of Commissioners, under the Resolve of the Legislature of the 9th of April last, to examine the subject of the introduction of soft water into Boston."

In September, the Committee on Water made a Report (see City Document No. 25), stating: That they had given the subject much attention; that they were more than ever impressed with the propriety and expediency of supplying the city with pure water; that one of the greatest obstacles to the union of all parties on the subject was the unfortunate difference of opinion between

the Commissioners as to the best source from which the supply should be taken, by which a feeling of uncertainty and distrust was thrown over the whole business. Another obstacle was, that the amount of water calculated to be furnished was on a scale to which the public mind was not accustomed, and for which it was not prepared, although not at all more than was necessary. Another source of opposition was from the proprietors of the Jamaica Pond Aqueduct, and they say no one can blame them for using all honorable means to preserve the value of their company. They also state, "that the consumption in the city at the present time is at the rate of eleven or twelve gallons per day to each individual, and they think that fourteen gallons will be sufficient, and recommend that the city purchase the Jamaica Pond Aqueduct, and that the Mayor be instructed to apply to the Legislature for leave to introduce the water from Spot Pond, which will be sufficient for many years to come."

The only action of the City Government in the year 1840 was the choice, on January 6th, of a Committee on Water; the Mayor, Jonathan Chapman, being its chairman.

Mayor Chapman, in his Inaugural Address, says of the introduction of a supply of pure water, "It is an enterprise which, if undertaken by the City, must involve a very considerable outlay, and it cannot but be admitted that some doubts may reasonably be entertained as to its pecuniary results, for at least a considerable period of time. It seems to me, therefore, that no prudent government would enter upon it, unless with the hearty concurrence of a large majority of its own members, and of the citizens generally.

"Notwithstanding the views which I have heretofore expressed in another branch of the government, and with less knowledge upon the subject, I now feel satisfied, from subsequent observation, that the public mind is not yet ready to sanction the undertaking by the City Government."

In 1841, on January 25th, a Committee on Water was chosen, and the only paper referred to them was a memorial of Charles Crocker, sent to the City Council August 16th, in which he proposed a plan for damming Charles River, for the purpose of supplying the city with fresh water; but no record can be found of their report, if they ever made one.

In the year 1842, no Committee on Water was appointed by the City Government, and there was no action whatever on the subject of the introduction of water.

January 16th, 1843, James C. Odiorne and others sent in a petition, asking

leave to form a company to convey water into the city from Spot Pond, which was referred to a Committee, the Mayor, Martin Brimmer, being its chairman, who reported, February 6th, that leave be granted, under certain conditions, namely, — that the supply of water should be pure; that the whole capacity of Spot Pond should be conveyed in iron pipes; that one or more reservoirs should be constructed within two miles of the City, at an elevation of not less than one hundred feet; that the use of the water for the extinction of fires should be free of charge; that the laying of pipes and the repairs of streets should be at the expense of the company; that the whole should be completed within three years; that the City should have the right to purchase the same at cost, and a certain percentage, not named therein; and that the act of the Legislature should not be construed to prevent the Legislature from granting an act to any other parties that might hereafter be established to convey water into the city. This report was laid on the table.

June 26th, Thomas A. Dexter and others sent in a communication in regard to Spot Pond Aqueduct Corporation, asking the city to subscribe for one-third of the capital stock, which was referred to this same Committee, who reported July 3d. They say: "That as the act provides that each stock-holder shall be liable for all the debts of said corporation, they think this is a sufficient reason why the City should not become an interested party, and they recommend the passage of the following Resolve," which was passed.

"*Resolved*, That it is inexpedient for the City of Boston to subscribe for any shares in the Spot Pond Aqueduct Corporation."

There was no further action on the subject during this year.

July 22d, 1844, a Committee was appointed "to consider and report what measures, if any, should be adopted to procure an abundant supply of pure soft water for the use of the city."

On the 29th of July, Walter Channing and 207 others petitioned the City Council that a general meeting in Faneuil Hall might be called, at an early day, to discuss the subject of supplying the City from Long Pond, which was referred to the last named Committee, who on the 22d of August made a Report on both subjects referred to them, in which they say: "In their opinion, the time has arrived when it is both expedient and necessary that pure water should be introduced into the City. Public opinion requires, and the public safety and necessity demand, that water should be brought into the city. They recommend Long Pond, and consider it inexpedient for the city to take any other source into consideration." They then review the several reports of the

Commissioners, and finish their report by recommending the passage of the following orders.

*Ordered*, "That three Commissioners be appointed, who shall, with as little delay as possible, report the best mode, and the expense of bringing the water of Long Pond into the City."

*Ordered*, "That the Joint Special Committee on the introduction of pure soft water into the City be and they are hereby authorized to appoint three Commissioners to report on the introduction of the water from Long Pond, and fix their compensation."

The Committee reported at the same time on the petition of Walter Channing and others, granting leave to call a meeting. On the 26th, the above orders were passed, and Tuesday evening, September 3d, at 7 o'clock, was assigned for the GENERAL MEETING of the CITIZENS.

At the next meeting of the Board of Aldermen, September 2d, they passed a Resolve, in which they state, "That in giving their consent to the appointment of three Commissioners to report on the Long Pond source, they did not intend to express any opinion as to the expediency of supplying the City from that pond, nor to preclude examination of other ponds hereafter, but as Long Pond was one of the prominent sources of supply, it should be thoroughly examined."

The Committee on Water appointed Messrs. P. T. Jackson, Nathan Hale and James F. Baldwin, Commissioners to make the examination, and to report on Long Pond.

September 3d, the CITIZENS' MEETING was held in Faneuil Hall, and was called to order by Samuel F. McCleary, Esq., the city clerk, who read the warrant calling the meeting, and His Honor the Mayor was chosen moderator.

This meeting, was a very large one; speeches were made by the Mayor, Henry Williams, Esq., Dr. Walter Channing, Mr. Crocker, and Mr. Whiting, all in favor of the immediate introduction of Long Pond water, at the expense of the City. The meeting was adjourned to the next evening. At the adjourned meeting, speeches were made by Messrs. Wright, Williams, and Mellen for the project, and by Messrs. Pickering and Thomas against it.

The meeting was continued by successive adjournments to Oct. 22d, to Nov. 14th, and to Nov. 26th. At this last date, addresses were made in favor of the project by the Hon. Abbott Lawrence and the Hon. John C. Gray; and a series of propositions were passed, to be sent to the Mayor and Aldermen, with the request that they might be submitted to the people to vote upon. The meeting then adjourned to meet Dec. 3d; at which time, there was

considerable excitement on account of the change that the City Council had made in the proposition to be voted upon as requested at the previous meeting, they having added the words after Long Pond, "*or from any other source that may hereafter be decided by the City Council to be best;*" and also put the whole management into the hands of the City Council, instead of the Water Commissioners as proposed by the meeting. These changes were objected to by Mr. Williams, Mr. Darracott, John C. Gray, Dr. Channing, and T. B. Curtis; and it was decided that if the City Council would not change the propositions, that the committee hereinafter mentioned were authorized to cause the same to be printed and distributed at the polls; and the following Committee were chosen to wait upon the Mayor and Aldermen, and request them to reconsider their action: Messrs. Edward Brooks, George Darracott, W. T. Eustis, Charles Leighton, J. M. Clark, and Charles Welch. The meeting then adjourned to meet at the polls.

On the records of the Legislature, we find that Charles Crocker and John M. Dearborn petitioned for a charter for a Charles River Aqueduct Company to furnish the city of Boston with water; and on March 17th, 1845, it was referred to the next Legislature, and an order of notice was ordered to parties interested, to appear and show cause, at the next General Court, why the prayer of the petitioners should not be granted; but as no farther record can be found, it was undoubtedly given up.

November 9th, 1844, the Commissioners made their Report to the Committee on Water, covering thirty pages (City Document 27); they say: First, that the amount to be brought into the city should be sufficient for 250,000 inhabitants, and make this the basis of their calculation; they estimate that 28½ wine gallons to each inhabitant will be fully sufficient, which will require 7,125,000 gallons per day. The next question to decide was "whether the water of Long Pond was sufficient to afford a constant supply to this amount," and after giving the particulars of their examination they say, "that Long Pond may be safely relied upon to produce a constant supply to this extent." They then proceed to the mode of introducing the water, and after giving an account of the Croton Water Works, which two of the Commissioners visited, they "recommend the construction of an aqueduct, from Long Pond to a Reservoir of sufficient capacity to contain a day's supply, to be formed on Corey's Hill, in Brookline, a distance of about sixteen miles." They propose that the conduit should be of brick, laid in cement, "of an oval form, five feet wide, and six feet four inches high in the interior, and broader in the lower section than in the upper." They propose that the brick-work shall be eight inches in thickness, and that the whole structure shall be covered with an

embankment of earth, four feet in depth in every part; the conduit to be laid with an inclination from a level of three inches in a mile, which would be sufficient for the proposed supply of water, by filling the aqueduct to a depth of three feet and ten inches, leaving a space of two and a half feet in height empty. "A line has been surveyed between the Pond and Corey's Hill," and they say that there is "no formidable obstacle to the construction of the works. There will be several places of deep cutting, none, however, exceeding thirty-six feet in depth;" that there will be "several large embankments, and some heavy excavations, mostly through sand and gravel, with no indication of rock to any great extent. No examination, however, had been made under ground."

"There are two valleys to be crossed, one at the crossing of Charles River near Newton Lower Falls, and the other near Lime Grove, beyond Brighton Village; these they propose to cross by two thirty-inch iron pipes."

They recommend for the supply of the city, that there should "be three or four Reservoirs of moderate dimensions: one to be situated on Beacon Hill, another on Fort Hill, the third on Dorchester Heights in South Boston, and a fourth on Copps Hill in the north part of the city." They say, that these may be dispensed with, by adopting larger size pipes for distribution, but they prefer the Reservoirs as the most effectual.

They recommend that two thirty-inch pipes be taken from the Corey Hill Reservoir, through Tremont Street to Boylston, and that branches shall be taken from these to the four Reservoirs, and such other branches as will be necessary for the supply of the city. They estimate the cost of the works, which they give in detail, at $2,118,535.83, which includes allowance for contingencies.

November 14th, 1844, the Committee made their Report to the City Council, together with that of the Commissioners, and recommend the adoption of the following Resolves.

*Resolved*, That it is expedient for the City to begin and complete the necessary works for the introduction of a supply of pure water.

*Resolved*, That it is expedient to draw the supply from Long Pond in the manner recommended by the Commissioners appointed under the order of August 26th, 1844.

*Resolved*, That it is expedient to begin the work as soon as necessary powers can be obtained from the Legislature.

*Resolved*, That it is expedient that the following question be submitted to the legal voters, on the second Monday of December next, — the citizens to vote in their respective wards Yea or Nay, viz: "Are you in favor of procuring a supply of water for the City, to be brought and distributed at the expense of the

City from Long Pond in Framingham, for the use of the inhabitants on their paying therefor a reasonable compensation to be fixed and established by a Board of Water Commissioners."

On November 21st, the Common Council passed the first resolve, and on the 26th, substituted the fourth resolve for the second, with the following amendment, "from Long Pond, *or such other sources as may hereafter be decided to be best* — upon such terms and under such regulations as the City Council may direct." The other resolves were indefinitely postponed. There was considerable discussion as to the proper form in which the questions should be submitted to the people to be voted upon, but finally the Mayor and Aldermen yielded to the committee of the Faneuil Hall meeting, and the following form was adopted, and voted upon on December 9th.

*First Proposition.* — Are you in favor of procuring a supply of water for the inhabitants of the City of Boston, to be brought, at the expense of the city, from Long Pond in Natick and Framingham, or from any of the sources adjacent thereto, on the condition that those of the inhabitants who may elect to take and use the same shall be required to pay for the water such reasonable tax as shall hereafter be fixed and established by a Board of Water Commissioners that shall be created? The vote on this was: yeas, 6,260; nays, 2,204.

*Second Proposition.* — Do you hereby vote to instruct the City Council to apply to the Legislature, in behalf of the city, for the grant of a suitable charter to carry into effect the object expressed in the first proposition? And do you hereby vote to instruct the Senators and Representatives elect, of the City of Boston, to exert their influence, at the ensuing session of the Legislature, to obtain a just and liberal charter for the object, as above set forth? The vote on this was: yeas, 6,252; nays, 2,207.

*Third Proposition.* — Are you in favor of procuring a supply of water for the inhabitants of the City of Boston, to be brought, at the expense of the city, from any source which may hereafter be decided by the City Council to be the best, on condition that those of the inhabitants who may eleet to take and use the same shall be required to pay for the water such reasonable tax as shall hereafter be fixed and established by a Board of Water Commissioners that shall be created? The vote on this was: yeas, 1,206; nays, 7,081.

*Fourth Proposition.* — Do you hereby vote to advise the City Council to apply to the Legislature in behalf of the city for the grant of a suitable charter to carry into effect the object expressed in the third proposition? and do you hereby vote to instruct the Senators and Representatives elect of the City of Boston to exert their influence at the ensuing session of the Legislature to

obtain a just and liberal charter for the object as above set forth? The vote on this was: yeas, 1,194; nays, 7,144.

Before the vote was taken on the above propositions, there were several communications in the newspapers in favor of, and in opposition to, the same; and the following Pamphlets were distributed among the inhabitants: First, "Thoughts about Water," (16 pages.) This is an article published in 1838, and signed "A Selfish Tax-Payer," with a few remarks as a preface to the same, advocating Spot Pond as the best source of supply. Second, "A Plea for Pure Water," being a letter to Henry Williams, Esq., by Walter Channing, with an address to the citizens of Boston, by Mr. H. Williams (39 pages).

Dr. Channing's letter does not recommend a source for the supply, but is upon the importance of having an ample supply, in the earliest possible time. The address of Mr. Williams advocates Long Pond, and gives his idea of the interest that would have to be paid on the cost of the work, and also of the income which would be derived from the same.

The committee of the Legislature in their report say: "Such an overwhelming majority of votes, if understandingly given, cannot be regarded, under the circumstances, otherwise than as very convincing, not to say conclusive evidence of a deep-felt and generally pervading want of water. It is evidence, also, of a settled determination on the part of the citizens, that, when this work is done, it shall be done by the City at its own expense."

The City Council ordered 7,000 of the Commissioners' Report to be printed and circulated before the municipal election, also the report of the Commissioners of 1837; but Mr. Hubbard, in his argument before the committee of the Legislature, says, "That the report of 1844 was printed and circulated before the election, *but that the report of* 1837 *was not circulated until after this vote had been taken.*"

On December 12th, the Mayor communicated to the City Council the result of the vote of the citizens; and on the 17th the Committee on Water recommended the passage of an order instructing the Mayor to make immediate application to the Legislature for the grant of such powers to the city as may be necessary to accomplish the object. This order was passed. (City Documents on subject of Water, for 1844, Nos. 6, 24, 24½, 25 and 26.)

# CHAPTER VI.

## 1845.

Petition to the Legislature for an Act — Hearing before the Committee of the Legislature — Act passed — Committee on Water chosen — Mayor Davis' Address — Act submitted to the citizens and rejected — Efforts made by the citizens previous to the vote being taken — Memorials from the citizens of the several wards — Several Petitions in favor of Spot Pond — Petition from the Spot Pond Aqueduct Corporation — Report of the Committee to whom was referred the several Petitions — Appointment of John B. Jarvis and Walter R Johnson, Engineers to make a survey — Their Report — Resolve passed.

JANUARY 1ST, 1845, the Mayor petitioned the Legislature for the necessary power to accomplish the object spoken of in the last chapter, which was referred on the 8th of January to a Joint Special Committee of the Legislature, Hon. Myron Lawrence, chairman; several remonstrances against the petition were also referred to the same committee, who held their first meeting Friday, January 31st. The remonstrants were, — 1st, Joseph Tilden and others of Boston, represented by William J. Hubbard, Esq.; 2d, Charles W. Cartwright and others of Boston, represented by Derby & Fuller; 3d, Paul Curtis and others of Medford; 4th, Proprietors of Middlesex Canal, represented by B. R. Curtis, Esq.; 5th, J. B. Faulkner and others of Billerica, also represented by B. R. Curtis, Esq.; 6th, R. G. Shaw and others, on behalf of East Boston, represented by D. S. Greenough, Esq.; 7th, Oliver Whipple of Lowell; 8th, Spot Pond Corporation, represented by Sidney Bartlett, Esq. Several other remonstrances were also sent in during the hearing. The city was represented by Mr. Pickering, the City Solicitor, Charles H. Warren, and Richard Fletcher.

Five days were occupied by the council in presenting the case to the committee, eight days by the examination of the thirty-three witnesses in opposition, and seven days in the examination of the nine witnesses in favor of the petition, and six days by the council in closing the case, making a session of twenty-six days, the last one being March 8th. The full Report of

the proceedings before the committee, including the closing argument of Mr. Hubbard, covers 198 pages.

March 13th, a Bill was reported by the committee, which, with a few amendments, was adopted, and approved by the Governor, March 25th.

January 23d, the Committee on Water was chosen by the City Council, William Parker being its chairman; and the papers and documents of the last year, 1844, were referred to them.

Mayor Davis, in his Inaugural Address, on February 27th, says: "The great and important measure to come before the City Government for their deliberation and action is the introduction of pure water into the city. It is now some twenty years since the introducing of pure soft water from abroad has been extensively discussed both in public and private.

"While the city was comparatively small, and confined to the grounds formed by nature, in which wells were easily sunk, and springs found, the necessity of introducing a supply from abroad was not so sensibly felt; but of late years, we have been gradually extending on all sides by the formation of new land, till at the present time more than one-third of the whole population of the city is located on grounds once flowed by the tides. On these made lands, great difficulty is experienced in finding good and sufficient springs; and when found, they are, by filtration of brackish water, soon rendered unfit for use. It has therefore been decided after mature discussion in public meetings held for the purpose, by a vote of about three to one, that it is expedient to have water brought into the city at the public expense from Long Pond, and by a vote of seven to one, that it should be introduced from some source; the water when introduced, to be received and paid for by the citizens, on such terms, and in such manner, as shall be decided upon by the Commissioners appointed for that purpose."

He then says: "That the petition has been presented to the Legislature for the necessary powers to carry out the wishes of the people," and after reviewing the Commissioners' Report, he adds: "The undertaking is one of great magnitude, surpassing anything hitherto entered upon by the City Government. It will involve the city in a large outlay, and when completed, in a heavy annual expense. It should therefore be proceeded in with great caution and prudence.

"The advantages of an abundant supply of pure soft water, to the health and happiness of the citizens is beyond calculation. I doubt not, should the undertaking be successfully carried through, at the cost estimated by the Commissioners, it could then be said by our citizens of the Long Pond water

works, as is now said by those enjoying the Croton water works, — 'No one regrets their construction.' "

March 10th, Mr. Parker having resigned, the Mayor, Thomas A. Davis, was appointed chairman of the Water Committee in his place; and, March 24th, the proceedings before the Legislature, previously referred to, were ordered to be printed.

In accordance with the requirements of the 20th Section of the Act of the Legislature, giving power to introduce the water into the city from Long Pond, the citizens upon the 19th of May, 1845, voted on the acceptance of the said Act, and it was rejected; 3,670 votes being in favor, and 3,999 votes being against it.

The principal cause of its rejection was the power and control over the works given to the Commissioners. Every effort to accomplish the object they desired was made by those that were in favor of, as well as those that were opposed to, the measure.

Previous to the vote being taken, the papers were filled with articles and communications upon the subject, both for and against, and the following documents were distributed to the inhabitants. 1st. "Remarks on the supplying the City of Boston with pure water," by John H. Wilkins (44 pages), advocating Charles River as the best source. 2d. "Letter from Lemuel Shattuck, in answer to interrogatories of J. Preston, in relation to the introduction of water into the City of Boston," (40 pages.) In this letter, we find this remarkable passage, "No one candidly viewing the whole subject, in my opinion will come to the conclusion that the wants of the city, now or for the next *twenty years*, will require the amount of water supposed by some to be needed; or that it will, upon any question of necessity, expediency, or economy, be justified in introducing the Long Pond water. And whether the city or a private corporation introduce it, some other source is certainly preferable." 3d. "How shall we vote on the Water Act?" (24 pages.) This was opposed to the act, the author's name not given. 4th. "Arguments and statements by a remonstrant," (25 pages.) 5th. Statement by the Spot Pond Aqueduct Company, (10 pages.) 6th. "Inquiry into the best mode of supplying the City of Boston with water, in reply to the pamphlets of Mr. Wilkins and Mr. Shattuck, by a member of the late Board of Water Commissioners," (70 pages.) This pamphlet ends thus: "If they wish to have the water introduced in their own lifetime, and not for the exclusive benefit of their posterity, they will vote for the acceptance of the act, which authorizes the introduction of the water of either Long Pond or Charles River, at the election of the City Council." 7th. "Further remarks on the supplying the City of Boston with pure water," (in

answer to document No. 6, above mentioned) (68 pages.) 8th. "Address of the Faneuil Hall Committee," (32 pages.) This address recommends the citizens by all means to vote for the act; it says, "*It is water! or no water!* It is present or speedy action, or interminable delay!" This was signed by Edward Brooks, Thomas B. Curtis, George Darracott, Henry Williams, Charles A. Wells, Thomas J. Lobdell, Charles Leighton, Nathaniel Greene, William Stearns, and Robert Cowdin. 9th. "Remarks on the present project of the City Government for supplying the inhabitants of Boston with pure soft water," by Henry B. Rogers, (39 pages.) This opposes the act, as well as the source of the supply. 10th. "Parliamentary sketches, and Water Statistics, being another word addressed to the citizens of Boston, in support of supplying the City with the pure water of Long Pond," by Walter Channing, M. D., (28 pages.)

June 3d, several Memorials from citizens of wards 2, 3, 5, 6, 7, 9, 10, 11 and 12, were received by the City Council, and referred to the Committee on Water; these were all in favor of the introduction of water, at the expense of the City, and against subscribing to one-third of the stock of the Spot Pond Aqueduct Company. There was also referred to that committee the petition of Samuel T. Armstrong, and ninety-nine others, asking that the question in regard to subscribing to one-third of the stock of the Spot Pond Aqueduct Company might be submitted to the people.

June 9th, the petition of John W. Fenno and others, on the subject of Spot Pond, was referred to the Committee on Water; and, on the same day, they were authorized to take such measures as they might deem necessary to decide as to the expediency of accepting the proposition of the proprietors of Spot Pond to sell said Pond to the City.

The petition of several of the Inhabitants of ward nine, on June 23d, praying for the city government to subscribe to the Spot Pond Aqueduct Corporation; the petition of Nathaniel Faxon and others on July 7th, for the same purpose; and the Memorial of J. Ball, July 21st, upon the subject of supplying the City with water, were referred to the same committee.

August 5th, Caleb Eddy, in behalf of the Spot Pond Aqueduct Corporation, sent in a petition to the Mayor and Aldermen, asking that the following proposition might be submitted to the citizens of Boston in their respective wards: "Shall the immediate introduction of pure water be secured by requesting the City Government to subscribe for the remaining third of the capital of the Spot Pond Aqueduct Company, with liberty to take the whole on the completion of the work pursuant to the charter?"

And in case a majority of voters shall approve the same, they respectfully

request the City Government, under the power conferred by the charter, to subscribe for one-third of the stock of the company which has been reserved for the city. They also state that application will be made to the Legislature to amend the charter so that it will be satisfactory to the City Council.

The individual subscribers to the stock of the above mentioned company also presented a petition in furtherance of that presented by Mr. Eddy.

These Petitions were referred to a *Special Committee*, who reported September 8th, recommending that the prayer of the petitioners be granted. No action however was taken, as the Joint Committee on Water, to whom the several Petitions of June 3d, 9th and 23d, were referred, had not made their report.

November 3d, Charles A. Wells and others, composing the Union Water Convention, asked that certain interrogatories might be put to the citizens at the next Municipal Election; which was referred to the Committee on Water.

November 24th, that Committee made their Report on the several petitions referred to them, in which they say: They wished to decide in the First place, how much water it would be desirable to introduce; Secondly, the amount of water to be obtained from Spot and Long Ponds, and Charles River at Watertown; Thirdly, as to the probable cost of each source. To ascertain these facts they deemed it expedient to appoint two impartial engineers from abroad, to examine and report; and they selected for this purpose, John B. Jervis, Esq., Chief Engineer of the Croton Water Works, and Professor Walter R. Johnson of Philadelphia; who entered upon their duties the last of June, and completed their work on November 18th, when they made their Report, therewith submitted.

In regard to the proposition of the proprietors of Spot Pond, they reported that it was inexpedient for the City to purchase the same; and also inexpedient for the City to subscribe to the stock of the Spot Pond Aqueduct Company.

The Report of Messrs. Jarvis and Johnson, together with the appendix, covers 160 pages. They commence their examination with Spot Pond; its capacity to be relied on as a supply is put at 1,500,000 gallons per day: they do not think it could be made a larger reservoir within a reasonable expense. After giving the route from this source, they give the estimate in detail, making the total cost, without distribution, $561,897.

Then comes the Charles River source, taking the water at the dam at Watertown, and carrying it thence through a brick aqueduct to the foot of Corey's Hill, and pumping it from this point to a reservoir on said hill. Of the capacity of this source, they say, that during a part of the month of August it varied from 20,298,752 to 69,485,166 gallons per day; in Sep-

tember, it varied from 9,367,100 to 24,101,222 gallons per day; the average was 19,108,451 gallons per day; in October from 1st, to 14th, it varied from 22,398,120, to 48,977,908 gallons per day; these extremes were caused by heavy rains. The estimated cost of getting water from this source, which is likewise given in detail, is, exclusive of distribution, for 2,500,000 gallons per day, $606,495; for 5,000,000 gallons per day, $1,009,218, for 7,500,000 gallons per day, $1,280,890.

Long Pond source comes next; they estimate the water-shed, including the pond, at 12,077 acres; but the available water-shed they put at 11,400 acres; its capacity estimated by the rain fall, they put at 10,176,570 gallons per day.

They remark: "From the indications on the shore, it appears that the usual high water mark has been about three feet above the floor, or bottom of the flume." Last year, 1844, the dam was raised to nearly 6.5 feet above the same level. It is now proposed to raise the dam to eight feet above the floor of the flume. "The pond is well exposed to the action of the winds, which tend to maintain the purity of the water. It would more appropriately be termed a lake.

"To provide for 7,500,000 gallons per day, the reservoir at 6.5 feet high will be amply sufficient; the 8-feet level will, however, give a better reservoir for this quantity, and as it provides, at a small extra expense, for a capacity of 10,000,000 gallons per day, it has been deemed proper to present it for consideration."

In regard to the size and shape of the conduit, they adopt the plan proposed by the Commissioners of 1844; but they recommend that a plastering of cement be put on the inside, from the bottom to the top water-line, and on the outside, from the top down to the chord line of the lower, or inverted arch. "The first, to more perfectly prevent water from escaping from the conduit, and the latter, more effectually to secure against the percolation of surface water into the conduit. Doubtless the conduit would do very well without the plastering, but it will be more perfect with it." They proposed to commence the Aqueduct near the head of the northern section, and that the bottom of the inside of the Aqueduct be placed three feet four inches below the floor of Knight's flume, and that it should be carried out some distance into the pond, so as to procure the water at a greater depth. The particulars as to the route are given, and a description of the culverts, waste weirs, ventilators, foundation walls, and embankments, with a diagram showing the same, including the conduit, iron pipes for crossing Charles River and Brighton

valleys, and the Reservoir at Corey's Hill. The estimate of the cost they make $1,681,599, exclusive of distribution.

They give the following table as the result of the gauging of the pond, from August 1st, to October 31st, 1845, inclusive — with the number of sets of observations taken each day, and the times during which the mills that used the water were in motion.

| | AUGUST. | | | SEPTEMBER. | | | OCTOBER. | | |
|---|---|---|---|---|---|---|---|---|---|
| Day of the month. | No. of sets of observations. | Total number of gallons discharged each day. | Time the mills ran. | No. of sets of observations. | Time the mills ran. | Total number of gallons discharged each day. | No. of sets of observations. | Time the mills ran. | Total number of gallons discharged each day. |
| | | | H. M. | | H. M. | | | H. M. | |
| 1 | 5 | 18,395,100 | 13.30 | 8 | 12.30 | 11,987,291 | 10 | 11.00 | 11,814,393 |
| 2 | 5 | 13,568,270 | 12.10 | 8 | 12.12 | 14,242,929 | 11 | 11.11 | 10,173,457 |
| 3 | | Sunday. | | 8 | 12.20 | 13,066,512 | 9 | 10.55 | 10,370,187 |
| 4 | 5 | 15,537,945 | 12.35 | 7 | 12.30 | 13,416,097 | 9 | 10.53 | 10,222,042 |
| 5 | 7 | 16,089,836 | 13.20 | 11 | 16.47 | 13,703,622 | | | Sunday. |
| 6 | 5 | 12,512,571 | 12.40 | 11 | 12.30 | 12,707,843 | 10 | 10.52 | 11,773,619 |
| 7 | 4 | 14,838,112 | 12.45 | | | Sunday. | 7 | 6.51 | 6,680,058 |
| 8 | 5 | 14,341,108 | 12.45 | 11 | 13.28 | 14,752,949 | 10 | 10.36 | 10,882,872 |
| 9 | 5 | 13,362,919 | 11.45 | 11 | 12.05 | 14,639,028 | 8 | 10.47 | 11,167,070 |
| 10 | | Sunday. | | 13 | 13.00 | 15,537,755 | 14 | 10.45 | 11,073,891 |
| 11 | 6 | 15,848,997 | 13.30 | 10 | 12.00 | 13,111,554 | 8 | 10.27 | 12,488,735 |
| 12 | 3 | 7,430,274 | 6.10 | 8 | 12.05 | 10,888,254 | | | Sunday. |
| 13 | 5 | 14,813,036 | 12.45 | 9 | 11.25 | 13,208,975 | 9 | 10.45 | 12,762,057 |
| 14 | 7 | 15,304,125 | 13.25 | | | Sunday. | 7 | 10.44 | 11,414,582 |
| 15 | 7 | 14,891,084 | 12.40 | 10 | 11.55 | 11,969,785 | 9 | 10.39 | 12,479,289 |
| 16 | 7 | 12,800,148 | 12.22 | 9 | 11.50 | 14,806,701 | 10 | 11.14 | 12,434,276 |
| 17 | | Sunday. | | 8 | 11.34 | 11,255,862 | 11 | 11.04 | 12,423,050 |
| 18 | 7 | 15,355,304 | 12.38 | 10 | 11.41 | 11,895,761 | 10 | 10.48 | 10,612,546 |
| 19 | 6 | 15,321,716 | 12.45 | 11 | 11.38 | 10,786,355 | | | Sunday. |
| 20 | 7 | 14,005,572 | 12.20 | 11 | 11.16 | 9,723,070 | 11 | 10.40 | 10,451,591 |
| 21 | 6 | 13,262,025 | 12.40 | | | Sunday. | 9 | 10.40 | 11,115,918 |
| 22 | 6 | 14,987,296 | 12.35 | 10 | 11.37 | 11,775,087 | 11 | 11.02 | 10,347,727 |
| 23 | 6 | 13,105,936 | 11.45 | 12 | 11.19 | 12,681,922 | 10 | 10.56 | 10,871,026 |
| 24 | | Sunday. | | 9 | 11.14 | 11,704,548 | 11 | 10.54 | 9,373,485 |
| 25 | 7 | 14,122,804 | 12.03 | 9 | 11.24 | 11,342,658 | 12 | 10.31 | 10,155,253 |
| 26 | 6 | 15,609,747 | 12.45 | 10 | 11.21 | 11,866,196 | | | Sunday. |
| 27 | 9 | 12.809,547 | 12.35 | 10 | 11.00 | 10,669,611 | 11 | 10.35 | 10,034,812 |
| 28 | 6 | 15,542,877 | 12.45 | | | Sunday. | 8 | 10.38 | 8,926,567 |
| 29 | 7 | 15,944,013 | 12.40 | 8 | 11,05 | 12,360,029 | 10 | 10.34 | 8,901,081 |
| 30 | 6 | 9,537,078 | 11.38 | 10 | 11.10 | 10,553,213 | 10 | 10.21 | 7,841,547 |
| 31 | | Sunday. | | | | | 9 | 10.20 | 8,205,331 |

The character of the waters, with an analysis of each, by Benjamin Silliman, Jr., is given.

Mr. Silliman states, in his Report on the analysis of the waters, that they were given him by numbers only, without any designation of their localities, and that he was still ignorant of their sources at the time his report was made. According to his analysis, Long Pond stood No. 1, Spot Pond No. 2, and Charles River No. 3.

Of the quantity to be supplied, they state, after giving the consumption of London, which they put at $188\frac{2}{10}$ gallons per house, and that of Philadelphia at 218 gallons, "We shall therefore base our estimate on 30 gallons to each person per day, as an average daily supply for the year."

Reviewing the several sources, they say: "In conclusion, it may be remarked that in view of the whole subject, we have no hesitation in stating as our opinion, that Long Pond is decidedly the most appropriate source to which the City can resort, to obtain an adequate supply of pure and wholesome water, for the present and future use of its inhabitants; and that it will not be a larger provision, in view of the probable growth of the City, than is desirable in works of this character and magnitude." It is further stated that 10,000,000 gallons per day could be brought from Long Pond at an expense of $2,651,643, including distribution; and that 7,500,000 gallons per day from Charles River would cost, including distribution, $2,733,580.

December 22d, the following Resolve was passed by the City Government.

*Resolved*, That it is expedient for the City at its own expense, to begin and complete the necessary works for the introduction of a full supply of pure water from Long Pond, as soon as the requisite power can be obtained from the Legislature.

This Resolve was then referred to the next City Government. (City Documents on subject of Water, for the year 1845, Nos. $12\frac{1}{2}$, 27, 29, 40, 41.)

# CHAPTER VII.

## 1846.

Mayor Quincy's Address — Committee on Water chosen — Application made to the Legislature — Act passed — Acceptance of the Act by a vote of the Citizens — The Act — Resolves passed relating to Contracts — Ordinance passed to regulate the proceedings of the Commissioners — Appointment of James F. Baldwin, Nathan Hale and Thomas B. Curtis as Commissioners — Their acceptance — Report of Committee on Finance — Communication from the Commissioners — Citizens furnished with Long Pond water for the first time — Ground first broken and by whom — Name of Long Pond changed to Lake Cochituate — Memorials in relation to the supply of water from Jamaica Pond — Memorial of Joseph W. Coburn and others, in relation to the transactions of the Water Commissioners — Report of Committee to whom were referred the several Petitions.

On January 5th, 1846, the Mayor, Josiah Quincy, Jr., in his Inaugural Address, says: "As to the introduction of water into the City, the time of deliberation is past; the time of action has come. A competent and disinterested Commission has decided that Long Pond is the source from which this blessing is to be derived, and our fellow-citizens have conferred upon the present administration, the honor of commencing this important work. As 'he gives twice, who gives quickly,' I would urge an immediate application to the Legislature for the necessary powers, and I doubt not, when the power is granted, it will be your endeavor, as it will be mine, to insure to every citizen the enjoyment of the blessing for the longest possible time, by introducing it at the earliest practicable moment."

On January 8th, the Standing Committee on Water was chosen, the Mayor being its chairman, to whom was referred that part of the Mayor's address above mentioned, to consider and report what action was necessary thereon. On the 15th, they reported, recommending the passage of the following Orders, which passed both branches of the City Council: "Ordered, that the Mayor be instructed to make application to the Legislature forthwith, for such

powers as are necessary for the introduction and distribution throughout the City, of water from Long Pond in Framingham."

"Ordered, that the Joint Standing Committee on Water be authorized to take such measures on the subject as they may deem expedient to further the objects of the foregoing order."

Application was at once made to the Legislature and was referred to a Committee, who reported an Act, which was passed, and signed by the Governor, March 30th, 1846.

As the Act provided that it should be submitted to the people for their acceptance or rejection within thirty days from the passage thereof, the Citizens were assembled at their various ward rooms, on the 13th of April, to vote yea or nay upon the question of its acceptance. On the following day, the Board of Aldermen examined the returns, and reported the votes as follows: yeas, 4,637; nays, 348. It was ordered that the result be published in the newspapers.

The Act as accepted is the one now in force, of which the following is a copy:

COMMONWEALTH OF MASSACHUSETTS.

In the year one thousand eight hundred and forty-six.

AN ACT,

FOR SUPPLYING THE CITY OF BOSTON WITH PURE WATER.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same as follows:*

SECTION 1. The City of Boston is hereby authorized, by and through the agency of three Commissioners, to be appointed in the manner hereinafter provided, to take, hold and convey, to, into and through the said City, the water of Long Pond, so called, in the towns of Natick, Wayland and Framingham, and the waters that may flow into and from the same, and any other ponds and streams within the distance of four miles from said Long Pond, and any water rights connected therewith; and may also take and hold, by purchase or otherwise, any land or real estate necessary for laying and maintaining aqueducts for conducting, discharging, disposing of, and distributing water, and for forming reservoirs; and may also take and hold any land on and around the margin of said Long Pond, not exceeding five rods in width, measuring from the verge of said pond when the same shall be raised to the level of eight feet above the floor of the flume, at the outlet thereof, and on and around the said other ponds and streams so far as may be necessary for the preservation and purity of the same, for the purpose of furnishing a supply of pure water for the said City of Boston.

The City of Boston shall, within sixty days from the time they shall take any

lands or ponds or streams of water, for the purpose of this act, file, in the office of the Registry of Deeds for the county where they are situate, a description of the lands, ponds, or streams of water so taken, as certain as is required in a common conveyance of lands, and a statement of the purpose for which taken; which said description and statement shall be signed by the said Mayor.

SECTION 2. The said city may by vote through the same agency, make and build one or more permanent aqueducts from any of the aforesaid water sources, to, into and through the said city, and secure and maintain the same by any works suitable therefor; may connect the said water sources with each other; may erect and maintain dams to raise and retain the waters therein; may make and maintain reservoirs within and without the said city; may make and establish such public hydrants in such places as may from time to time be deemed proper, and prescribe the purposes for which they may be used, and may change or discontinue the same; may distribute the water throughout the city, and for this purpose may lay down pipes to any house or building in said city, the owner, or owners thereof, having notice and not objecting thereto; may regulate the use of the said water within and without the said city, and establish the prices or rents to be paid therefor. And the said city may, for the purposes aforesaid, carry and conduct any aqueduct, or other works by them to be made and constructed, over or under any water-course, or any street, turnpike-road, railroad, highway, or other way, in such manner as not to obstruct or impede travel thereon; and may enter upon, and dig up any such road, street, or way, for the purpose of laying down pipes beneath the surface thereof, and for maintaining and repairing the same; and, in general, may do any other acts and things necessary, or convenient and proper, for the purposes of this act.

SECTION 3. Three Commissioners shall be appointed by the City Council, who shall, during their continuance in office, execute and perform, and superintend and direct the execution and performance of all the works, matters and things mentioned in the preceding sections which are not otherwise specially provided for in this act; they shall be subject to such ordinances, rules and regulations, in the execution of their said trust, as the City Council may, from time to time, ordain and establish, not inconsistent with the provisions of this act, and the laws of this Commonwealth. They shall respectively hold their offices for the term of three years, next after their said appointment, unless the aqueducts and works aforesaid shall be sooner completed; but they, or either of them, after having had an opportunity to be heard in his or their defence, may be removed at any time by a concurrent vote of two-thirds of each branch of the City Council; and in case of a vacancy in the Board of Commissioners, by death, resignation or removal, such vacancy shall be filled by the appointment of another Commissioner, in manner aforesaid, who shall hold his said office for the residue of the said term of three years, with all the powers, and subject to all the restrictions aforesaid. A major part of said Commissioners shall be a quorum for the exercise of the powers, and the performance of the duties of the said office. They shall, once in

every six months, and whenever required by the City Council, make and present, in writing, a particular report and statement of all their acts and proceedings, and of the condition and progress of the works aforesaid.

SECTION 4. Before the appointment of the Commissioners aforesaid, the City Council shall establish and fix the salaries or compensation to be paid to the Commissioners for their services, and the said salaries of the said Commissioners, so established and fixed as aforesaid, shall not be reduced during their continuance, respectively, in said office.

SECTION 5. Whenever the said office of Commissioners shall cease, either by the expiration of the said term of three years from the original appointment, or by the completion of the aqueducts, and works mentioned in the preceding sections of this act, all the rights, powers and authority given to the City of Boston by this act, shall be exercised by the said city, subject to all the duties, liabilities and restrictions herein contained, in such manner and by such agents, officers and servants, as the City Council shall from time to time ordain, appoint and direct.

SECTION 6. The said City of Boston shall be liable to pay all damages that shall be sustained by any persons in their property by the taking any land, water, or water rights, or by the constructing of any aqueducts, reservoirs, or other works for the purposes of this act.

And if the owner of any land, water, or water rights, which shall be taken as aforesaid, or other persons who shall sustain damage as aforesaid, shall not agree upon the damages to be paid therefor, he may apply by petition, for the assessment of his damages, at any time within three years from the taking of the said land, water, or water rights as aforesaid, and not afterwards, to the Court of Common Pleas in the county in which the same are situate; such petition may be filed in the clerk's office of said Court, in vacation or in term-time, and the clerk shall thereupon issue a summons to the City of Boston, returnable if issued in vacation, to the next term of the said Court, and if in term-time, returnable on such day as the said Court shall order, to appear and answer to the said petition; the said summons shall be served fourteen days at least before the return day thereof, by leaving a copy thereof, and of the said petition, certified by the officer who shall serve the same, with the Mayor or clerk of the said city; and the said Court may, upon default in hearing of the said city, appoint three judicious and disinterested freeholders of this Commonwealth who shall, after reasonable notice to the parties, assess the damages, if any, which such petitioner may have sustained as aforesaid; and the award of the said freeholders, or of the major part of them, being returned into and accepted by the said Court, shall be final, and judgment shall be rendered, and execution issued thereon, for the prevailing party, with costs, unless one of the said parties shall claim a trial by jury as hereinafter provided.

SECTION 7. If either of the parties mentioned in the preceding section, shall be dissatisfied with the amount of damages awarded as therein expressed, such party may, at the term at which such award was accepted, or the next term

thereafter, claim, in writing a trial in said Court, and have a jury to hear and determine at the bar of said Court, all questions of fact relating to such damages, and to assess the amount thereof; and the verdict of such jury being accepted and recorded by the said Court, shall be final and conclusive, and judgment shall be rendered and execution issued thereon; and costs shall be recovered by the said parties respectively, in the same manner as is provided by law, in regard to proceedings relating to the laying out of highways.

SECTION 8. No application shall be made to the Court for the assessment of damages for the taking of any water rights, until the water shall be actually withdrawn or diverted by the said city under the authority of this act; and any person or corporation whose water rights may be thus taken and affected, may make his application aforesaid, at any time within three years from the time when the waters shall be first actually withdrawn or diverted as aforesaid.

SECTION 9. For the purpose of defraying all the costs and expenses of such lands, estates, waters and water rights, as shall be taken, purchased or held for the purposes mentioned in this act, and of constructing all aqueducts and works necessary and proper for the accomplishment of the said purposes, and all expenses incident thereto, the City Council shall have authority to issue, from time to time, notes, scrip, or certificates of debts, to be denominated on the face thereof, "Boston Water Scrip," to an amount not exceeding in the whole, the sum of three millions of dollars, bearing interest at a rate not exceeding the legal rate of interest in this Commonwealth; and said interest shall be payable semi-annually, and the principal shall be payable at periods not more than forty years from the issuing of the said scrip, notes or certificates respectively. And the said City Council may sell the same, or any part thereof from time to time, at public or private sale, or pledge the same for money borrowed for the purposes aforesaid, on such terms and conditions as the said City Council shall judge proper.

SECTION 10. In addition to the sum of three millions of dollars mentioned in the preceding section, the said City Council may, whenever and so far as may be necessary, issue and dispose of notes, scrip, or certificates of debt, in the manner prescribed in the preceding section, to meet all payments of interest which may accrue upon any scrip by them issued: *Provided however*, that no scrip shall be issued for the payment of interest as aforesaid, after the expiration of two years from the completion of said aqueducts and other works; but payment of all interest that shall accrue after that time, shall be made from the net income, rents, and receipts for the use of the water, if they shall be sufficient for that purpose, and if not, then the payment of the deficiency shall be otherwise provided for by the City Council. All notes, scrip, and certificates to be issued as aforesaid, shall be signed by the Treasurer, and Auditor, and countersigned by the Mayor of the said city, and a record of all such notes, scrip, and certificates shall be made and kept by the said Treasurer and Auditor respectively.

SECTION 11. The City Council shall, from time to time, regulate the price or

rents for the use of the water, with a view to the payment, from the net income, rents and receipts therefor, not only of the semi-annual interest, but ultimately of the principal also of the "Boston Water Scrip," so far as the same may be practicable and reasonable. And the said net surplus income, rents and receipts, after deducting all expenses and charges of distribution, shall be set apart as a Sinking Fund, and shall be appropriated for and towards the payment of the principal and interest of the said scrip; and shall, under the management, control, and direction of the Mayor, Treasurer, and Auditor of the City, or the major part of them for the time being, who shall be trustees of the said fund, be applied solely to the use and purpose aforesaid, until the said scrip shall be fully paid and discharged. And the said trustees shall, whenever thereto required by the City Council, render a just, true and full account to the said City Council of all their receipts, payments, and doings, under the provisions of this section.

Section 12. At any time after the expiration of two years from the completion of the works mentioned in the second section of this act, and before the reimbursement of the principal of the "Boston Water Scrip" hereinbefore mentioned, if the surplus income and receipts for the use of the water distributed under the provisions of this act, at the price established by the City Council, after deducting all expenses and charges of distribution, shall, for any two successive years, be insufficient to pay the accruing interest on the said scrip, then the Supreme Judicial Court, on the petition of one hundred or more of the legal voters of the said city, praying that the said price may be raised and increased so far as may be necessary for the purpose of paying, from the said surplus income and receipts, the said accruing interest, and upon due notice of the pendency of such petition given to the said city in such manner as the said Court shall order, may appoint three Commissioners, who, upon due notice to the parties interested, may raise and increase the said price, if they shall judge proper, so far as may be necessary, in their judgment, for the purpose aforesaid, and no further. And the award of said Commissioners, or the major part of them, being returned to the said Court, at the then next term thereof, for the county of Suffolk, and accepted by the said Court, shall be binding and conclusive, for the term of three years next after the said acceptance, and until the price so fixed by the Commissioners shall, after the expiration of said term, be changed or altered by the City Council.

Section 13. If the surplus income and receipts for the use of the water distributed under the provisions of this act, at the price established by the City Council, after deducting all expenses and charges of distribution, shall, for any two successive years, be more than sufficient to pay the accruing interest on the "Boston Water Scrip," hereinbefore mentioned, then the Supreme Judicial Court, on the petition of one hundred or more of the legal voters of the said city, who may deem the said price unreasonably high, and pray for a reduction thereof, and upon due notice of the pendency of said petition given to the said city in such manner as the said Court shall order, may appoint three Commissioners,

who, upon due notice to the parties interested, may, if they shall judge proper, reduce the price established by the City Council, *provided*, that such reduction shall not be so great that the surplus income and receipts aforesaid will, in the judgment of the said Commissioners, be thereafter insufficient for the payment of the said accruing interest. And the award of the said Commissioners, or the major part of them, being returned and accepted as mentioned in the preceding section, shall be binding and conclusive, in the same manner, and to the same extent, as therein provided in regard to awards made pursuant to the provisions of that section.

And the said Court may, at their discretion, order the costs on such petitions as are mentioned in this and the preceding section, and of the proceedings thereon, or any part thereof, to be paid by either of the said parties, and may enter judgment and issue execution therefor accordingly.

Section 14. The occupant of any tenement shall be liable for the payment of the price or rent for the use of the water in such tenement; and the owner thereof shall be also liable if, on being notified of such use, he does not object thereto; and if any person or persons shall use any of the said water, either within or without the city, without the consent of the city, an action of trespass on the case may be maintained against him or them, by the said city, for the recovery of damages therefor; *provided*, *however*, that this act shall not be so construed as to prevent the inhabitants of Natick, Framingham, Sherburne and Wayland, from using so much of the water hereby granted as shall be necessary for extinguishing fires, and for all ordinary household purposes, under such regulations of the said City Council as may be essential for the preservation of the purity of the same.

Section 15. If any person or persons shall wantonly or maliciously divert the water, or any part thereof of any of the ponds, streams or water sources which shall be taken by the city pursuant to the provisions of this act, or shall corrupt the same, or render it impure, or destroy or injure any dam, aqueduct, pipe, conduit, hydrant, machinery, or other property held, owned or used by the said city by the authority and for the purposes of this act, every such person or persons shall forfeit and pay to the said city three times the amount of damages that shall be assessed therefor, to be recovered by any proper action. And every such person or persons may moreover, on indictment and conviction of either of the wanton and malicious acts aforesaid, be punished by fine, not exceeding one thousand dollars, and imprisonment not exceeding one year.

Section 16. The said City of Boston is hereby authorized to purchase and hold all the property, estates, rights and privileges of the Aqueduct Corporation incorporated by an act passed February twenty-seventh, in the year one thousand seven hundred and ninety-five, and by any convenient mode may connect the same with their other works.

Section 17. The Mayor and Aldermen of the City of Boston, shall notify and warn the legal voters of the said city to meet in their respective wards on such

day as the said Mayor and Aldermen shall direct, not exceeding thirty days from and after the passage of this act, for the purpose of giving their written votes upon the question, whether they will accept the same; and if a majority of the votes so given upon the question aforesaid shall be in the negative, this act shall be null and void.

SECTION 18. This act shall take effect from and after its passage.

HOUSE OF REPRESENTATIVES, March 30, 1846.

Passed to be enacted.

SAMUEL H. WALLEY, JR., *Speaker.*

IN SENATE, March 30, 1846.

Passed to be enacted.

W. B. CALHOUN, *President.*

Approved.

GEORGE N. BRIGGS.

March 30, 1846.

At the time of the acceptance of this Act, nearly every ward in the city had an association called the WATER UNION; these associations used every means in their power to obtain the Act, and to get it accepted by the people.

April 21st, 1846, the following Resolve was referred by the City Council to the Committee on Water, who reported in favor thereof, and it was passed.

*Resolved*, That the Boston Water Commissioners, in all their contracts, require security for the faithful payment of all the Mechanics and other laborers employed on the works.

The same day the Committee were authorized and empowered to make all necessary arrangements and agreements in regard to the Ponds in the neighborhood of Long Pond and tributary to the Concord River, to secure the same for the use of the city, if in the opinion of the Committee, it should be expedient so to do.

An Ordinance was passed by the City Council to regulate the proceedings of the Commissioners to be appointed under the Act; section first of which provided that the Commissioners should receive a salary of $3,500 per annum each, payable quarterly.

Section second, that they should have full power and authority to take or purchase land, make contracts, and provide materials.

Section third, made it the duty of the Commissioners to take the entire charge, and oversee the construction of the works.

Section fourth, provided that they should furnish the City Council with estimates from time to time, to enable them to raise the required funds.

Section fifth, provided that they should make a return to the Mayor of all estates taken, with a full description of the same.

Section sixth, provided that in the event of any lawsuit, the Commissioners should aid and assist the Counsel employed to defend the same.

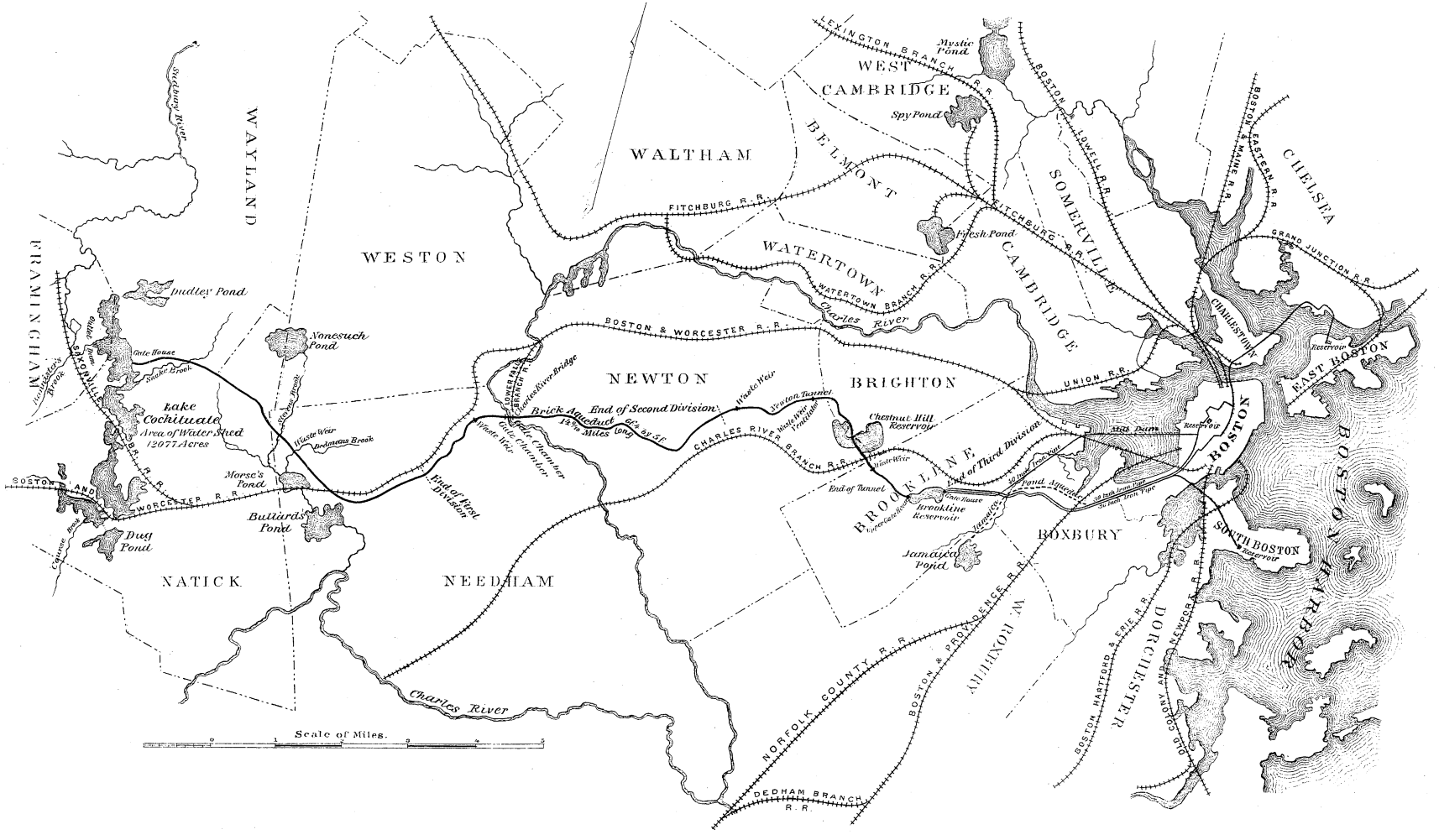
Section seventh, provided that they should keep a correct Record of their proceedings, and that they should report in writing, once a month, to the Committee on Water; and once in three months, to the City Council.

Section eighth, gave the Commissioners power to draw drafts on the Treasurer from time to time, to pay expenses; said drafts first being countersigned by the Mayor.

Section ninth, provided that the above Ordinance could be altered or amended, except the clause relating to the salaries of the Commissioners, at the discretion of the City Council. (See City Document No. 14½, for 1846.)

On the fourth day of May, Messrs. James F. Baldwin, Nathan Hale and Thomas B. Curtis, were chosen by the City Council as the Commissioners under the Act, and were duly notified of their election, which they accepted on the eleventh.

On the day of their acceptance, the Committee on Finance were ordered to consider and report what financial arrangements are necessary to provide the funds required for carrying on the work. They reported, June 22d, the following Order, which was adopted. "Ordered, that the Mayor be authorized under the direction of the Committee on Finance, to negotiate a loan or loans, binding upon the City, and receivable by its Treasurer, for an amount not exceeding Five Millions and a half of dollars, payable at such times and places, and on such conditions and rates of interest, as the Committee on Finance shall approve, within the authority granted by the Statutes for introducing water into the City of Boston." They also stated in their Report, that the sum of $500,000 would be required for the financial year ending May 12th, 1847; $1,000,000 during the next year, and the balance in the third; and that the Commissioners said, that they know of no reason why the expense should exceed the estimate of $2,651,643; the Committee however, assume the cost at $3,000,000.



WAYLAND
WESTON
WALTHAM
WEST CAMBRIDGE
BELMONT
WATERTOWN
CAMBRIDGE
SOMERVILLE
CHELSEA
FRAMINGHAM
NATICK
NEEDHAM
NEWTON
BRIGHTON
BROOKLINE
ROXBURY
W. ROXBURY
DORCHESTER
CHARLESTOWN
EAST BOSTON
SOUTH BOSTON
BOSTON
BOSTON HARBOR
Sudbury River
Dudley Pond
Nonesuch Pond
Lake Cochituate
Area of Water Shed 12077 Acres
Morse's Pond
Bullards Pond
Dug Pond
Charles River
Brick Aqueduct
End of Second Division
End of First Division
End of Third Division
Chestnut Hill Reservoir
Brookline Reservoir
Jamaica Pond
Mystic Pond
Spy Pond
Fresh Pond
Charles River Bridge
Gate Chamber
Waste Weir
Newton Tunnel
Mill Dam
Reservoir
Pond Aqueduct
Jamaica
Gate House
Snake Brook
Stevens Brook
Dedmans Brook
Cauvese Brook
Rimbaster's Brook
Oulte Dam
Upper Gate House
Upper Gate Chamber
Waste Weir
Ventilator
Waste Weir
Waste Weir
Reservoir
Reservoir
Reservoir
Scale of Miles.
0
1
2
3
4
5
FITCHBURG R.R.
BOSTON & WORCESTER R.R.
WATERTOWN BRANCH R.R.
LEXINGTON BRANCH R.R.
BOSTON & LOWELL R.R.
BOSTON & MAINE R.R.
BOSTON EASTERN R.R.
GRAND JUNCTION R.R.
UNION R.R.
CHARLES RIVER BRANCH R.R.
LOWER FALLS BRANCH R.R.
BOSTON AND WORCESTER R.R.
SAXONVILLE BR. R.R.
NORFOLK COUNTY R.R.
BOSTON & PROVIDENCE R.R.
DEDHAM BRANCH R.R.
BOSTON HARTFORD & ERIE R.R.
OLD COLONY AND NEWPORT R.R.

The Commissioners, not considering themselves vested with sufficient power to carry out an agreement with the owner of Long Pond, which they considered desirable, sent a communication to that effect to the City Council, June 15th. On the 17th, the following Order was passed: "Ordered, that the Standing Committee on Water be authorized to purchase such lands and buildings as will be necessary for the construction of the aqueduct and reservoirs in the introduction of the water from Long Pond."

On July 4th, the Citizens were supplied on Boston Common with *Long Pond Water*, for the *first time*; this was accomplished by the enterprise of a few of our citizens, who had the same brought into the city in barrels for that purpose.

THE GROUND WAS FIRST BROKEN
FOR
THE AQUEDUCT AT LONG POND,
AUG. 20TH, 1846.
And on that day the name was changed from
LONG POND,
TO
LAKE COCHITUATE;
*Its Original Indian Appellation.*

For an account of the Ceremonies on that occasion, see Part II., Chapter I., Page 97.

October 26th, a Memorial was received from Edward A. Raymond and others, and on the 28th, another from Josiah Bradlee and others, respecting the supply from Jamaica Pond, and asking the city to adopt such measures as may be deemed expedient to relieve them from their present difficulty in obtaining a supply of water; these memorials were referred to the Committee on Water. Joseph W. Coburn and others sent in a Memorial, December 16th, requesting information upon the subject of the appointments made by the Water Commissioners, of Engineers and others; this was also referred to the Committee on Water, but was not reported on by them until the following year, as hereinafter mentioned.

During this and the following years, several Communications and Reports were made by the Commissioners to the City Council, but as they more appropriately belong under the head of the transactions of the Water Commissioners, we shall refer to most of them there.

December 17th, the Committee on Water made their report on the petitions of Edward A. Raymond and others, and Josiah Bradlee and others. They say: That they consider the petition equivalent to a request that the city should purchase the Jamaica Pond Aqueduct under the authority granted in the Water Act, and that they had applied to the Water Commissioners to obtain their opinion as to its value; and that they, in their reply, recommend its purchase, if it can be made for the sum of $80,000. This price is the estimated value of the property and franchise in the hands of the present proprietors after the introduction of water by the city. To the city, it would be of greater value. (City Documents on subject of Water, for year 1846, Nos. 14½, 20, 21, 26, 32, 47.)

# CHAPTER VIII.

## 1847.

Committee on Water chosen — Petition of Silas P. Barnes and others in relation to the transactions of the Commissioners — Report of the Committee to whom was referred the Petition of Coburn and others, and Barnes and others — Communication of Water Commissioners on the subject of the Petitions — Hearing on the Petitions — Instructions to Committee on Streets and Sewers — Petition of C. W. Cartwright and others to have Beacon Hill Reservoir enlarged — Commissioners' notice that they had decided to enlarge it — Service-pipes ordered to be laid — Ordinance for sale of land — Report of Finance Committee — Compensating Reservoirs.

On January 11th, 1847, the Committee on Water was appointed, Mayor Quincy, Chairman.

On the 18th, a Petition was received from Silas P. Barnes and others, praying that information may be given to them and to the public respecting the manner in which certain contracts have been made, and officers appointed by the Water Commissioners. This Petition, together with that of Joseph W. Coburn and others, before mentioned, were referred to the Committee on Water, who made their Report, on the 17th of February, as follows: "That after an *ex parte* hearing of the petitioners, they called upon the Water Commissioners for a written statement of their doings as they related to contracts and appointments, and in general for all information on the subject that could be communicated without prejudice to the interests of the City. In reply to their request, they received the accompanying Report, which in the unanimous opinion of your committee, entirely exonerates the Commissioners from the charge or suspicion of having neglected or lost sight of the true interests of the City in the contracts or appointments therein referred to; and it is the request of the Petitioners and the recommendation of the Committee that a large number of copies of this Report and the accompanying documents be printed for the use of the Council and others interested."

The communication of the Water Commissioners referred to, covers over

thirty pages, giving the estimates received, also the contract and specification for the construction of the Beacon Hill Reservoir. That the complaint may be more fully understood, we give the following extract from the Report.

"The complaints of the petitioners, on which the principal stress has been placed, are founded on the supposed proceedings of the Commissioners, in awarding the contracts for the important work of building the City Reservoir on Beacon Hill. These complaints are set forth in the petition in the following words:

'*That while ostensibly sealed proposals were to be the medium of other and larger contracts, and that such contracts were to be given to the lowest bidder who could and would furnish good and sufficient bonds for the performance of the same, they have not so proceeded. That they have (as we believe) disregarded the more favorable estimates proposed by citizens of this city for the performance of said work, who were abundantly able and willing to perform the said contracts and give the required bonds for the faithful performance thereof.*

'*That an unjust and undue preference was shown to others, and that contracts were entered into without regard to such sealed proposals, and without that publicity which would insure their accomplishment at the least cost to the city.*

'*That by so doing, many thousands of dollars have been, and are being, needlessly expended, adding greatly to the heavy taxes with which the public is already burdened.*

'*That we, feeling aggrieved that a due regard has not been paid to the proposals of our citizens, and an explanation of the causes which led to this disregard of said proposals not having been satisfactorily given, when requested by those whose interests are deeply affected, thereby casting an imputation of incompetency upon our Boston Mechanics, to the manifest injury of their reputation, and the great detriment of the public, etc.*'

"The Commissioners cannot forbear to express their surprise that imputations and charges of so grave a character should have been made against them, unsupported by a particle of truth. There is no foundation in fact for one of the complaints in their elaborate enumeration, as the following statement of the material circumstances of the case will fully show.

"The contract in question was awarded on the 5th December, to Messrs. Daniel Carmichael, Joseph Gonder, Jr., J. S. T. Stranahan, John Duff, Edward Learned & Sons, and Lewis Stoddard, gentlemen of high reputation as contractors on public works, and some of them of great experience in the execution of works of similar character to that to be here executed, and of even greater magnitude."

They then go on at some length in regard to the character of the work

required, and the importance of its being done well, and in the time specified; and state that there were nineteen proposals received, and that the four lowest offers were rejected after careful consideration, for specific reasons; none of these, however, were from the signers to the petition. All the bids were given in detail, and the quantities were estimated before the estimates were opened by the engineer: the accepted bid, according to his quantities, amounted to $158,050, and this was the lowest responsible offer. They then give the estimates of several of the petitioners made on the same basis: Messrs. Whetherbee, Coburn & Co., $164,406; Mr. Nelson Curtis, of Roxbury, $162,354; Messrs Johnson, Richards, Munn & Co., O. T. Rogers, and T. Hollis, Jr., $158,575; Messrs. Jeremiah Whetherbee & Co., $177,642.75. "These statements show that the contract complained of was not only ostensibly but actually given to the lowest bidder who could give a satisfactory warranty of its performance; that more favorable estimates proposed by citizens of Boston were not disregarded, for none such were offered; and, consequently, that no imputation of incompetency has been cast upon the mechanics or citizens of Boston by the non-acceptance of their proposals."

They close their Report by saying: "It must be unnecessary to occupy the time of the Committee in replying to the intimations that the Commissioners have been induced, through the influence of the engineers, to give a preference to proposals for contracts from strangers over those of our own citizens; such intimations are as unjust to the engineer as they are injurious to the Commissioners, being as destitute of truth, as they will doubtless be regarded of probability."

This reply of the Commissioners was not satisfactory to the petitioners, and they asked to have a hearing; and, on the 15th of March, the whole subject was referred back to the Committee, with instructions to give the parties a hearing, which they did on April 13th. The petitioners appeared by their counsel, J. C. Park and George D. Wilmot, Esqrs.; the Water Commissioners were notified, but did not attend. At this hearing the argument on the part of the petitioners was based on the quantities of each kind of work that it would take to build the Reservoir, which, according to their estimate, would have given them the contract by $1,268; but, on the other side, Mr. Whitwell made a statement to the Committee that he estimated the quantities of each kind of work as near as the circumstances of the case would admit; this he said was done before any propositions were opened, and when opened, each was estimated by it, which gave the contract to Messrs. Gonder & Co. The Committee, in their Report, review the whole case, and conclude with declaring unanimously, that nothing has been shown to justify the complaints, and that, in their

opinion, the power of making contracts is judiciously intrusted to the discretion of the Water Commissioners, and recommend that the petitioners have leave to withdraw their petitions.

April 14th, the Committee on Streets and Sewers were ordered to render every assistance to the Commissioners to facilitate the distribution of water within the limits of the city.

On the same day, a petition was received from C. W. Cartwright and others, asking that the Beacon Hill Reservoir might be made larger by the addition of the Bowdoin School-house and the buildings on Temple Street, which was referred to the Committee on Water; but as the Commissioners gave notice, May 17th, that they had decided to enlarge the same by taking the buildings proposed by the petitioners, they made no report thereon.

An order was passed on June 8th, 1847, directing that the service-pipes should be laid at the same time as the mains, as far as it could be done with due regard to the public interest.

To meet the case of more land being purchased than would be required for the Reservoirs and other works, and of any after sale or leasing of the same, and to insure that the amount received therefor should be applied for the purposes of the Act for supplying the City of Boston with pure water, the following Ordinance was passed July 7th:

"The Joint Committee on Public Lands, in concurrence with the Water Commissioners, are hereby authorized to make sale, conveyance or lease of any lands or property which may have been purchased or conveyed to the City, for the purpose of introducing water, or that may hereafter be so purchased or conveyed, the proceeds of such sales to be applied to the purposes of the Act for supplying the City of Boston with pure water."

On July 20th, the Committee on Finance made a Report, in which they state that they advertised from the 30th of April to July 8th, for proposals for a loan of $1,000,000 at 5 per cent interest, and on the latter day, the bids were opened, and the stock apportioned to the highest bidders, and that it was taken at an average of about ninety-four for one hundred.

September 27th, Samuel W. Hall and others petitioned the City Government that the water from Lake Cochituate might be carried to East Boston; and on October 20th, a memorial, from Franklin Haven and others, was received in aid of the petition of Samuel W. Hall and others. These were both referred to the Committee on Water, who did not report until the following year.

November 8th, 1847, an order was passed requesting the Commissioners to

give their opinion as to the best material to be used for the service-pipes, also to obtain the opinion of the Consulting Physicians on the same subject.

At this time, the Commissioners thought it best to build Compensating Reservoirs, to serve as a substitute for the waters which might be diverted from Concord River, and at their request the following order was passed.

"*Ordered*, That the Water Commissioners be authorized to make such purchases of lands and water rights in the name, and on account of the City of Boston, and to erect such dams, embankments, and other works, as they shall deem necessary and expedient for forming Reservoirs of water to serve as a substitute for the waters which may be diverted from Concord River, and to make payment therefor, in the same manner as for lands and water rights purchased by virtue of the act for supplying the City of Boston with pure water: *Provided*, the same does not exceed the sum of fifty thousand dollars." (City Documents on the subject of Water, for year 1847, Nos. 18 19, 27, 28, 29, 30, 43, 44.)

# CHAPTER IX

## 1848

Committee on Water chosen — Petition to the Legislature for additional power — Service-pipes to be laid at the expense of the city — The Pipe over the Boston and Worcester Rail Road Bridge — Report of the Committee on the subject of carrying the water to East Boston — Commissioners' Report on the best material for Service pipes—Celebration on the Introduction of the water into the City — Discussion on Water Rates — City Solicitor's opinion on the subject — Memorial of the Jamaica Pond Aqueduct Corporation — Report of the Committee to whom the Memorial was referred — Ordinance to further regulate the proceedings of the Water Commissioners.

THE Standing Committee on Water was chosen on the 10th of Jan. 1848; and on the 31st, the Mayor was authorized to petition the Legislature for additional power, so as to make temporary loans and to pay the same off when the loan of $3,000,000 was negotiated, as provided for in the act for introducing water.

March 8th, an order was passed that the Service-pipes should be put in at the expense of the City. This was done on the recommendation of the Committee on Water, with the advice and approval of the Commissioners.

May 15th, the Commissioners sent in a communication in which they say: "That they find serious difficulties in carrying the main pipes leading from the Brookline Reservoir across the Boston and Worcester Railroad Bridge, at Tremont Street. After a careful consideration, they have come to the conclusion that the only eligible mode is to carry the pipe over the bridge, either upon the westerly sidewalk, or through the middle of the roadway.

"In either case the two pipes, with the box in which it will be necessary to enclose them, will occupy a space of about seven feet in width, and two feet if on the sidewalk, or two and a half feet if in the middle of the street, above the surface of the street. The Commissioners are therefore desirous of obtaining the consent of your Board, to the laying of the pipes in one or the other of those modes, and also your opinion as to the mode which is liable to the least

objection." This was referred to the Committee on Paving, who reported in favor of laying the pipes in the westerly sidewalk, an Order for which was passed.

During the month, the Committee on Water made their Report on the Petition of S. W. Hall and others, of November 1847, that the water from Lake Cochituate might be carried to East Boston, giving the petitioners leave to withdraw their petition. This was done for reasons set forth by the Water Commissioners in a Report made by them to the committee. In the petition referred to, it was suggested to accomplish this object by means of an arched gallery, of six feet internal diameter, through which a water and a gas pipe may be laid under the bed of the channel from the Peninsula to East Boston.

The Commissioners in their Report state that there had been careful surveys and soundings made; and after giving their opinion as to the structure of the earth on both sides, and a statement of the Thames Tunnel in England, which was an enterprise undertaken after two other projects for the same object had failed, they add *that the Thames Tunnel is a work far inferior in magnitude to that proposed by the petitioners.* The width of the Thames, at that part at which the tunnel crosses it, is one thousand and thirteen feet; that of the water between Boston and East Boston is twenty-two hundred and fifty feet, and the depth of the water in the Thames is less, by at least fifteen feet, than it is in the East Boston channel. The water of the Thames repeatedly broke into the tunnel during the progress of the excavation, and the work was only accomplished by building strong interior walls of brick masonry, surmounted by an arch, as the tunnel advanced." They close their Report, which covers eleven pages, by saying: "The Commissioners are therefore of opinion that it is inexpedient to adopt any measures for conveying water across the channel to East Boston by means of a submarine tunnel, as recommended by the petitioners."

August 14th, the Commissioners sent in their Report, covering sixty-seven pages, on the best material to be adopted for distributing water pipes. The Board of Consulting Physicians made their Report, on the same subject, on April 5th, without recommending any material.

As this is a question in which all the citizens are interested, many extracts will be taken from that Report of the Commissioners. They say: The Board of Consulting Physicians made a Report on the various substances which have been used for water pipes, to which they have given careful attention. The authors of the Report do not, however, recommend any material

for the use above specified, nor have they expressed an opinion as to that which is entitled to a preference for this purpose.

They have expressed the opinion that "*pipes of cast or wrought iron*, may be safely used for the transmission of water as far as health is concerned," but they do not recommend their use. They state, on the contrary, that "iron is easy of oxidation," that it "impairs the purity of the water, and in small pipes is liable to obstruction from the accumulation of its oxide."

They have expressed the opinion that *copper pipes*, effectually tinned throughout by reliable workmen, are a safe material for the transmission of water, "*so long as the internal coating keeps in repair*," but the guarded terms, in which this opinion is stated, imply a doubt of the durability of such an internal coating.

They state that *leaden pipes*, in certain waters, and under certain circumstances, are known to communicate a highly deleterious quality to their contents, yet that "a large portion of the population of Boston, Philadelphia, New York, and London, have for years consumed the water introduced from various sources through leaden pipes, with apparent impunity;" but, as has been remarked above, they do not recommend the use of this or any other material.

The Water Commissioners were therefore under the necessity of deciding independently of any such recommendation, by the aid of such information as they were able to obtain from the above Report, and from other sources.

They say, "In coming to a decision upon the question, we have given careful attention to the information and opinions of the scientific gentlemen who replied to the inquiries addressed to them by the Board of Consulting Physicians, and particularly to the results of the very thorough investigation and experiments of Professor Horsford, of Harvard University. These results appear to us to be of great value, and in corrobation of the great mass of evidence derived from a very extensive observation of the use of leaden pipes for the supply of cities and towns, for a long series of years, entirely satisfactory and conclusive."

They then state, that while this investigation was going on, they had been using one and a half and two inch diameter iron pipes; that the cost of this description of pipes, including the laying down, was much higher than lead. "There is also a further objection to the use of these pipes, that with the greatest caution which can be used in laying them, they are more liable to be broken than pipes of lead, or other flexible metal. In the mean time, we have given attention to experiments which have been made of pipes constructed of various other materials. Tin has been used for coating the internal

surface of pipes of iron, lead and copper, for the purpose of preserving them against the action of the water. Pipes of each of these descriptions have been strongly recommended, on some limited experience, but we are of opinion that there is not sufficient evidence of the durability of the coating, in either form, to justify its adoption for general use. Pipes of block tin appear to be in some respects preferable to either description of those formed of other metals, and merely coated with tin. The cost of tin per pound is about four times that of lead, but as it is of greater tenacity than lead, a smaller quantity of metal serves to give the pipes a sufficient degree of strength, so that pipes composed of block tin, of a suitable thickness, can be procured at about double the cost of pipes of equal strength composed of lead. But the experiments detailed in the report of Professor Horsford, as well as information derived from other sources, show that tin is gradually dissolved by the Cochituate and other similar waters; and that the decomposition does not in a short time cease, like that of lead in the same water, but continues, as far as any experiment has been made, indefinitely. Tin is liable to rapid decomposition, by being brought in contact externally with certain acids and gases, to which in various positions, it will be exposed. Whether any sensibly deleterious effect upon the water is produced by the gradual decomposition of the tin pipe, is a question which has not been satisfactorily determined; but for reasons briefly stated, we are of opinion that, independently of the question of comparative cost, tin is no better adapted for the distribution of the water of Cochituate Lake, than lead, and that probably it would prove less durable.

"Pipes manufactured of malleable iron are used to some extent, in various places, for the distribution of water for domestic uses. They are, in every respect, well adapted to the purpose, with the exception of their liabilities to corrode by the action of the water within, as well as the effects of moisture on the external surface. They are stronger than lead, and not more expensive. They can be made of any desirable dimensions, and are not liable, like cast-iron, to be broken by an unequal pressure on the different parts. The experience of their use, however, so far as it has come to our knowledge, is too limited to enable us to form a positive judgment of the force of the objection above mentioned.

"It has been apprehended that the effect of rust would be such as to render the water unfit for use in the washing of clothes and linen, and that in process of time, it would close the aperture of the pipe.

"Pipes formed of sheet iron, coated internally with hydraulic cement, have been recently introduced, and they promise to be highly useful under certain circumstances. Where laid in the earth, and in situations exposing

them externally to moisture, they are protected by a covering of hydraulic cement, which, besides preserving the iron against rust, gives an additional strength to the pipe. Whether they can be economically used for the distribution of water from the mains has not been fully determined by any experiment within our knowledge."

After speaking of the experiments made by Professor Horsford, they say: "These experiments demonstrate that the action of the comparatively pure water of lakes and rivers upon bright bars of lead, which on their immersion in it, is distinctly perceptible, *ceases after a period of a few days; and this immediate action of the water upon the surface of lead, forms a coating, which for all practical purposes is impervious to water, and entirely insoluble in it.* This coating remains unchanged during any period in which it has thus far been immersed; its appearance after some months or years of immersion, in the case of the Croton, is quite the same as within three or four days from the first immersion. The water on the first and second days in which the lead is so immersed, and during the continuance of any perceptible action on the surface of the leaden bars, shows traces of a mixture of lead, on trial by the ordinary tests; but on the repeated removal of this water, and substitution of other water from the same sources after the coating is formed, no trace of lead is discoverable by the most effective tests, after any length of exposure of the water to contact with the lead, which will ordinarily occur.

"It has, however, never been doubted by those who have investigated this subject, that the water of wells and springs of *certain descriptions*, and in *certain situations*, exerts a much more powerful and a continued effect upon lead with which it comes in contact, and that cases of paralysis, cholic, and even death, have been traced to the drinking of water contaminated by this poisonous mixture. The negative evidence that no well authenticated cases of these diseases have occurred, in consequence of drinking the waters furnished by the Public Water Works of the Cities of London, Philadelphia, New York, and many other places, when distributed through leaden pipes, authorizes the belief that the scattered cases of disease of this description, which have been usually traced to the use of water from wells and springs, have arisen from some property peculiar to the water from those sources, and are not common to water derived from lakes and rivers."

After speaking of experiments made by Professor Horsford, they say: "that in a letter from him dated July 25th, he expressed the following opinion; 'without an attempt at further enumeration of the conclusions at which I have arrived, I may state, with whatever emphasis uninterrupted investigation from the first of last February until now may justly give to the opinion, that

*Cochituate water may be served from leaden pipes, connected with iron mains, without detriment to health.*' The opinion here expressed would command a high degree of confidence if it stood alone. Confirmed as it is by an abundance of collateral testimony, derived from long experience, we consider it entitled to entire confidence." They then give the testimony from several parties in New York, Philadelphia, London, Paris, Baltimore, Albany, Troy, and several other places, all confirming the opinion expressed by Professor Horsford; and add, "we have therefore, on these considerations, *resolved to use leaden pipes,* for conducting the water to houses." "Having thus expressed our views in regard to the material of which the pipes should be composed, we proceed to comply with the Order of the City Council, requesting our opinion 'as to the best and most economical mode of introducing water into private houses.'" From this part of the Report of the Committee, we make the following extract: "The pipes should be five-eighths of an inch in diameter, weighing about three pounds to a foot in length, and be carried through such part of the cellar as will afford the best protection from frost; and in conducting the pipes through a house, they should be carried near a chimney, or in such position that they will be protected against freezing.

"All pipes not *thoroughly protected,* should be laid with such an inclination as will admit of their being emptied, when there is danger from cold, by opening a discharge cock, to be placed at the lowest point.

"Pipes passing through coal cellars and other exposed places, should be carefully protected; all pipes should be so placed as to be accessible, for examination or repair; and to every stopcock should be attached a vacant pipe, or other air chamber above it, which, by the compression of the air on the sudden shutting off of the water, may serve to relieve the pipe from the shock of what is called the *water hammer.* Otherwise, on account of the rapidity of the current, from the pressure of so high a head of water as will rest on the pipes throughout the greater part of the city, they will be liable to burst, or to be gradually expanded by repeated shocks."

This Report was signed by two of the Commissioners, Messrs. Hale and Curtis.

On the Eleventh of September, the Commissioners notified the City Council that THE MAIN PIPE FOR CONDUCTING THE WATER INTO THE CITY WOULD BE LAID ON OR BEFORE THE 25TH DAY OF THE ENSUING OCTOBER, A. D. 1848; AND WOULD BE IN READINESS FOR INTRODUCING THE WATER ON THAT DAY.

An Order was passed, directing an appropriate PUBLIC CELEBRATION of the event, and on the 18th of September, the following Committee were chosen to arrange, and superintend the Celebration.

JOSIAH QUINCY, JR., *Mayor.*
BENJAMIN SEAVER, *President of Common Council.*

*Aldermen:*

| | |
|---|---|
| William Pope, | John P. Ober, |
| Billings Briggs, | Moses Grant. |

*Common Council:*

| | | | |
|---|---|---|---|
| Abel B. Munroe, | Ward 1 | J. P. Bradlee, | Ward 7 |
| Henry Davis, | " 2 | William A. Harrington, | " 8 |
| Thomas Critchett, | " 3 | Tisdale Drake, | " 9 |
| Samuel W. Hall, | " 4 | Samuel Wales, Jr., | " 10 |
| W. W. Greenough, | " 4 | G. W. Frothingham, | " 11 |
| Wm. D. Coolidge, | " 5 | Joseph Smith, | " 12 |
| John P. Putnam, | " 6 | | |

It was decided that the Celebration should take place on the twenty-fifth day of October, 1848, and "as an appropriate form of celebration, to invite the Citizens of the Metropolis, with such of the Public Officers, the Municipal Authorities, the Militia, various Public Bodies, and Institutions of the Commonwealth, as might be disposed to accept the invitation, to unite in a procession embracing a cavalcade and military escort, and to be present on the introduction of water at the Fountain on the Common."

The invitations were generally accepted. The weather was propitious and at the break of day, a salute of one hundred guns, accompanied by the ringing of the bells, opened the ceremonies." At an early hour the streets were filled with people, attracted by the decorations, mottoes and devices, by which the principal avenues through which the procession was to pass, were embellished. These were very numerous, well arranged, and in good taste, and some of them extremely beautiful.

The Procession was under the direction of Francis Tukey, Esq., as Chief Marshal, who was assisted by the following Aids and Assistant Marshals.

Gen. John S. Tyler,
Gen. Josiah L. C. Amee,
Col. William Schouler,
John T. Heard,
Henry N. Hooper,
George G. Smith,
Col. Newell A. Thompson,
John C. Tucker,
Moses Kimball,
Capt. Robert B. Forbes,
Ebenezer Dale,
Dr. J. W. Warren,
Capt. Gilbert Brownell,
Hon. John C. Park,
Peter C. Jones,
Gideon F. Thayer.

The Order of the Procession was as follows. FIRST, Military Escort, consisting of about thirty companies from all parts of the State, who were under the command of Gen. B. F. Edmunds.

SECOND, The Fire Companies of the City and neighboring cities and towns, dressed in their various uniforms.

THIRD, The Cavalcade, which was a very numerous body of horsemen.

FOURTH, The Civil Procession in eight divisions. The first division was under the direction of Hon. John C. Park, as Chief Marshal, assisted by Edmund Dexter and Charles L. Woodbury, Esqrs., as Aids, and comprised Public Officers of the City, State, and United States, City and Town Authorities throughout the State, and Scientific, Historical, Musical and other Societies.

The second was under the direction of George G. Smith, as Chief Marshal, assisted by Capt. Granville Mears and Joseph M. Wightman, as Aids, and comprised the various Mechanical Associations and the Marketmen of Boston and vicinity. The different sections of this division exhibited appropriate emblems of their various occupations.

The third was under the direction of Col. Newell A. Thompson, as Chief Marshal, assisted by Maj. George M. Thatcher and Hamilton Willis, as Aids, and consisted of the Masonic Fraternity throughout the New England States.

The fourth was under the direction of John C. Tucker, as Chief Marshal, assisted by James Egan and Peter Higgins, as Aids, and consisted of the Scots' Charitable Society, and the various Irish societies.

The fifth was under the direction of Moses Kimball, as Chief Marshal, assisted by Dr. D. Harwood and Amos W. Dana, as Aids, and consisted of the various Temperance societies throughout the New England States.

The sixth was under the direction of Capt. Robt. B. Forbes, as Chief Marshal, assisted by Thomas Motley, Jr. and William B. Bemis, as Aids, and

consisted of the various Marine societies, Seamen, and Boat clubs of Boston and vicinity.

The seventh was under the direction of Gideon F. Thayer, as Chief Marshal, assisted by B. B. Mussey and Abel Tompkins, as Aids, and consisted of the various Water Unions, Citizens, and the Masons employed on the Water Works.

The eighth was under the direction of Ebenezer Dale as Chief Marshal, assisted by Daniel Sharp, Jr., and Henry C. Wainwright, as Aids, and consisted of the Children of the Public Schools of Boston, Charlestown, Cambridge, Roxbury and Chelsea, the Farm School and Orphan Asylum, and the Sisters of Charity, with Children over eight years of age.

The Fire Department was under the direction of Peter C. Jones as Chief Marshal, assisted by Thomas A. Williams and Henry Hart as Aids.

The route of the Procession was through Tremont, Court, Cambridge, Chambers, Green, Pitts, Merrimac, Blackstone, Salem, Charter, Hanover, Richmond, Commercial, South Market, around Faneuil Hall, Merchants' Row, State, Washington, Warren and Tremont streets to the Common through Park Street gate. It took about two hours for the whole to pass a given point.

The SERVICES on the COMMON were brief, on account of the lateness of the hour at which the procession reached the spot; they were as follows:

FIRST, Hymn by George Russell, Esq., which was sung by the Handel and Haydn Society and the audience.

SECOND, Prayer by Rev. Daniel Sharp, D.D.

THIRD, Ode by James Russell Lowell, Esq., which was sung by the School children.

FOURTH, ADDRESS by the HON. NATHAN HALE, one of the WATER COMMISSIONERS.

FIFTH, ADDRESS by the HON. JOSIAH QUINCY, JR., MAYOR OF BOSTON.

At the conclusion of the Mayor's Address, he asked the Assembly if it were their pleasure that the water should now be introduced. An immense number of voices responded, "Aye!" Whereupon the gate was gradually opened, and the water began to rise in a strong column, six inches diameter, increasing rapidly in height, until it reached an elevation of eighty feet.

After a moment of silence, shouts rent the air, the bells began to ring, cannon were fired, and rockets streamed across the sky. The scene was one of intense excitement, which it is impossible to describe, but which no one can forget. In the evening, there was a grand display of fireworks, and all the public buildings and many of the private houses were brilliantly illuminated.

There having been some discussion as to whether the Water Rates were to be fixed by the City Council or the Water Commissioners, the following Order was passed on December 14th: *Ordered*, That the City Solicitor be requested to present to the Common Council, his written opinion upon the construction of the "Act for supplying the City of Boston with Pure Water," in reference to the power of the Water Commissioners to establish the Water Rents, and whether the City Council has power to establish the same.

On the 18th, Peleg W. Chandler, Esq., the City Solicitor, made his reply, in which, after reviewing the act, he says: "Upon the whole, I am of the opinion upon the two branches of the question submitted to me; *first*, that the Water Commissioners may, in the first instance, and while they are in office, *establish* the Water Rents free from the control of the City Council; and *secondly*, that the City Council are authorized and required to *regulate* these rents from time to time, *after the expiration of the office of the Water Commissioners*, with a view to the payment, from the net income, rents and receipts therefor, not only of the semi-annual interest, but ultimately of the principal also, of the 'Boston Water Scrip,' so far as the same may be practicable and reasonable."

The directors of the Jamaica Pond Aqueduct sent a Memorial to the City Council, November 10th, praying the City to purchase the property, in which they say: "That they do not ask redress as equals, who suffer in competition with equals, but as a few private individuals, who are sacrificed on the altar of public accommodation, — a very few, whose property is destroyed, for the benefit of the whole remainder." This was referred to the Committee on Water, who reported, December 14th, recommending the desired purchase, for the sum of seventy-five thousand dollars, and an Order was passed authorizing the same, in one branch of the City Council, but it was non-concurred in by the other.

December 26th, an ordinance was passed to further regulate the proceedings of the Commissioners, as follows:

*Ordered*, SECTION 1. For the purpose of supplying Cochituate Water to the inhabitants of the City of Boston, and for ensuring prompt payment in advance, of the charges therefor, that it shall be the duty of the Water Commissioners to cause an entry to be made, or a record kept of the sums required to be paid, per annum or otherwise, by each applicant for water, from and after the first day of January next, with the purposes for which the value so supplied is to be used, and the limitations, if any, of the quantities thereof, and to report a statement of the same, previous to the first of January next, and subsequently, from time to time, as the said entries shall be made, to the City Treasurer.

SECT. 2. It shall be the duty of the City Treasurer, to keep a proper register of all the water charges so returned to him by the Water Commissioners; to receive payment thereof for account of the City, in the same manner in which the City Taxes are collected, and to keep a distinct account of all sums so received under the name of Water Rent, subject to be appropriated according to law; and it shall be the duty of the Treasurer, in all cases in which the sums so reported to him by the Water Commissioners as payable for the use of water shall not be promptly paid in conformity with the specific regulations which shall be made by the Water Commissioners, to give notice of such neglect to said Commissioners, who shall thereupon be authorized to cut off the further supply of water to the party so delinquent, and to enforce payment in such manner as they may legally direct. (City Documents on subject of Water, for year 1848, Nos. 18, 22, 32, 42, 43, 44, 45, 50.)

# CHAPTER X.

## 1849.

Mayor Bigelow's Address — Committee on Water chosen — Subject of carrying the Water to East Boston referred to the Committee — Water to supply the Fountains in the State House Yard — Petition to the Legislature for an Additional Act — Committee's report in favor of carrying Water to East Boston. Engineer's estimate on the same — Water Commissioners' term of office extended — Election of Commissioners — Additional Act accepted — The Act as accepted — Messrs. Chesbrough and Whitwell's Report on carrying the water to East Boston — Commissioners directed to carry the water to East Boston —Ordinance to regulate the Water Board — Water Board elected.

On January 1st, 1849, Mayor Bigelow, in his Inaugural Address, says: "The city at last enjoys the long-coveted blessing — a copious supply of Pure Water. The only prominent objection to Boston as a place of residence is removed, by a system of works which promises to be a permanent memorial of the public spirit and judgment of its authors, and of the skill and energy of those, under whose auspices it approximates completion.

"At the time of the recent celebration, ample details concerning this subject were laid before the public, and I shall not consume your time by repeating." After speaking of the length of pipe laid in the city, he says: "There remains yet considerable to be done to finish this great undertaking, by carrying out the plan upon which it has so far been executed. The Commissioners inform me that the Reservoir upon Beacon Hill will probably be completed by the close of the summer; and that on Dorchester Heights, before the end of the year. The term of office of the Commissioners will expire, by limitation of law, in May next, and I recommend that the City Council make seasonable application to the Legislature for the renewal of their term, for such time, and with such modifications of their power, as may seem advisable."

The Committee on Water was chosen January 8th, and that part of the Mayor's address above mentioned was referred to them to consider and report; and, on the 19th of February, the same committee were directed to

consider the expediency of carrying the water to East Boston, and to report plans and estimates.

March 19th, an Order was passed, directing the Water Commissioners to carry water to the State House Yards, for supplying such Fountains as the Commonwealth may erect there at their own expense; provided, however, that the City retain the entire control of the water to be used for such purpose.

The Mayor was authorized to petition the Legislature for an additional Act to enable the City to carry the water to East Boston, and to increase the Water Loan one and a half million of dollars.

The Committee on Water made their Report on the expediency of carrying the water to East Boston, April 19th. They say: That the population of East Boston is 9,130; the number of houses, 1,217; and the number of families, 1,780; that they are satisfied that that section of the City is not sufficiently supplied with water; that if the water was conveyed thither, it would be generally taken; and that at the request of the Committee, the Water Commissioners had caused a survey to be made by Mr. Chesbrough, of four routes, and from their examination of the subject, it seemed to them that the route numbered 3, was preferable to the others. The cost of this route they made as follows:

| | |
|---|---|
| 18,779 feet of 20-inch Pipe, at $6.00 per foot, | $112,674 00 |
| 1,102 " Piling and Boxing Charles River, at $10.00 per foot | 11,020 00 |
| 3,212 " " " " Mystic " " $7.00 " " | 22,484 00 |
| 1,429 " " " " Chelsea Creek, " $12.00 " " | 17,148 00 |
| 4 inverted Syphons | 20,500 00 |
| Dredging | 2,500 00 |
| | $186,326 00 |
| Add for contingencies 20 per cent. | 37,265 20 |
| Cost of Route | $223,591 20 |
| Reservoir of 5,000,000 gallons capacity | 46,163 02 |
| Distribution of 57,800 feet, Hydrants, etc. | 107,753 80 |
| For Land damages say | 20,000 00 |
| Amounting to | $397,508 02 |

or in round numbers, $400,000, *as the whole expense of route and distribution.* The low estimate of the cost of the Reservoir, is founded on the liberal offer of the East Boston Company to present to the City one acre of land on a site of sufficient elevation for all purposes of supply.

"It is obvious that the character of the projected work is very different

from that of the portions of the Aqueduct previously constructed. Those portions of it to be built over navigable waters are liable to certain objections. Although the Aqueduct, with the assistance of the Reservoir, will furnish a sufficient supply in all ordinary emergencies, it is nevertheless true that there are contingencies arising from the nature and position of the structure, upon which it is to rest for nearly one mile of its passage, which may affect its security and durability." Notwithstanding these objections, your Committee being fully satisfied that East Boston has an undoubted right to a supply of pure water, and that it is practicable to carry it there for a moderate sum, ask leave to offer the subjoined Order, giving the Commissioners full power to carry the water to East Boston, provided the cost should not exceed $400,000.

No action was taken upon this Report.

The engineer, E. S. Chesbrough, says, in his Report: "That the plan proposed is free from objections, it would be presumptuous to assert; for there must be attached to it some degree of insecurity arising from the perishable nature of the materials to be used, the possibility, — though very slight probability,— of destruction by fire, and the danger of shocks and injuries from floating bodies. It is believed, however, that its execution in the first instance is practicable, and that the *ordinary* injuries to which it would be liable, either from decay or accident, might be repaired: and, by means of the proposed Reservoir, without cutting off a supply of water from the inhabitants of East Boston." In this Report, the estimates are given in detail to the several routes proposed. He recommends, however, route No. 3, the estimate for which has already been given. No. 1 was estimated at $406,119.22; No. 2 at 416,055.22; No. 4 at $372,516.82.

On April 23d, the Committee on Water made a Report, recommending that the term of office of the Water Commissioners be extended; and on April 30th, the following Ordinance was passed in addition to the Ordinances to regulate the proceedings of the Commissioners.

SECTION 1. There shall be chosen by concurrent vote of the City Council, before the seventh day of May, in the year one thousand eight hundred and forty-nine, three Commissioners, who shall be known and called the "Boston Water Commissioners," who shall hold offices for the space of eight months from the time of their election, unless sooner removed, as hereinafter provided, and who shall receive, in full compensation for their services, such salaries as the City Council shall determine.

SECT. 2. The said Water Commissioners, or either of them, after having had an opportunity to be heard in his or their defence, may be removed at any time, by a concurrent vote of two-thirds of each branch of the City

Council; and in case of a vacancy in the Board of Commissioners, by death, resignation, or removal, such vacancy shall be filled by the appointment of another Commissioner in the manner aforesaid.

SECT. 3. The said Water Commissioners shall, during their continuance in office, execute and perform, and superintend and direct the execution and performance of all the works, matters and things necessary or proper to be executed and performed in carrying out the true intent and objects of the Act for supplying the City of Boston with Pure Water, passed March 30th, 1846, and in general shall be the agents, officers and servants of the City of Boston for the purposes aforesaid. They shall have all the powers, so far as the same are proper and necessary, heretofore granted to the Water Commissioners by the ordinances to which this is an addition; and shall be subject to the duties and restrictions in said Ordinances mentioned, and to any others that may hereafter be imposed by the City Council; provided, however, that nothing herein contained shall be construed as restricting, in any manner, the right of the City Council to regulate the Water Rates.

SECT. 4. This Ordinance may be repealed or amended at any time by the City Council.

On May 4th, the City Council elected Nathan Hale, James F. Baldwin and Thomas B. Curtis, Water Commissioners for eight months.

The Additional Act of the Legislature for power to carry the water to East Boston and to increase the water debt was signed by the Governor on May 1st, and was referred to the Committee on Water, May 7th, who reported, May 28th, the following Resolves, which were passed by a vote of forty-three to three in the Common Council, and unanimously by the Board of Aldermen:

*Resolved*, That the Act of the Legislature of Massachusetts, entitled "an Act in addition to an Act for supplying the City of Boston with Pure Water" be and the same is hereby accepted by the City Council of the City of Boston.

*Resolved*, That in the opinion of the City Council it is expedient that the water of Long Pond be conveyed to and through East Boston, provided that the cost of the same shall not exceed the sum of $400,000.

The Act as accepted is as follows:

COMMONWEALTH OF MASSACHUSETTS.

In the year One Thousand Eight Hundred and Forty-Nine.

An Act in addition to "An Act for supplying the City of Boston with Pure Water."

*Be it enacted by the Senate and House of Representatives, in General Court assembled, and by the authority of the same, as follows:*

SECTION 1. In addition to the notes, scrip, or certificates of debt authorized to be issued by the ninth section of the Act entitled "An Act for supplying the City of Boston with Pure Water," passed on the thirtieth day of March in the year one thousand eight hundred and forty-six, being chapter one hundred and sixty-seven of the acts of that year, the City Council of the City of Boston, are authorized to issue from time to time, notes, scrip, or certificates of debt, to be denominated on the face thereof, "Boston Water Scrip," to an amount not exceeding in the whole, the further sum of one million five hundred thousand dollars, for the same purposes, and in the same manner, and upon the terms and conditions specified in said section.

SECT. 2. Wherever any damages shall have been sustained by any persons, in their property, by the taking of any land, water or water rights, or by the constructing of any Aqueducts, Reservoirs, or other works, for the purposes of this Act, and of the Act to which this is in addition, and such person shall neglect to institute proceedings against the City of Boston, according to the provisions of the said Act, for the space of five months, it shall be lawful for the City of Boston, to commence such proceedings, which shall go on and be determined in the same manner as if commenced by the persons who shall have sustained such damage, and if such persons, on receiving due notice, shall not come in and prosecute the proceedings so instituted, judgment shall be entered against them, and they shall be forever barred from recovering any damages under said Act.

SECT. 3. The City of Boston is hereby authorized to convey the water of Long Pond to, into and through that part of Boston, called East Boston, by laying their Aqueduct or water pipes through the City of Charlestown, and town of Chelsea, and for that purpose may have all the rights and privileges, and shall be subject to all the liabilities mentioned in the Act to which this is in addition. And the said City of Boston may make any suitable structures, for the purpose of conveying the said water over or under the tide waters within the jurisdiction of this Commonwealth, *provided*, that such structures shall be approved of by a Commissioner, to be appointed for that purpose by the Governor and Council, and to be compensated by the City of Boston, *provided further*, that the authority granted by this section shall not be exercised without the consent of the City Council of said City first had and obtained.

SECTION 4. This Act shall not take effect unless accepted by the City Council of the City of Boston.

HOUSE OF REPRESENTATIVES, April 30th, 1848.

Passed to be enacted.

FRANCIS B. CROWNINSHIELD, *Speaker.*

IN SENATE, May 1st, 1849.

Passed to be enacted.

JOSEPH BELL, *President.*

May 1st, 1849. Approved. GEORGE N. BRIGGS.

After the above Act was accepted by the City Council, the Water Commissioners, requested the Engineers, Messrs. Chesbrough and Whitwell, to re-examine the plans and estimates made by them on April 2nd and 9th; which they did, and made their Report July 21st.

From their Report, we make the following extracts: "Therefore with regard to the general plan proposed in the former estimates, we should not recommend any alteration, except to increase the amount of protection to the river crossings, especially at the draws.

"The location of the proposed Reservoir at a level of sixteen feet below that of Brookline, having been objected to, has received special consideration. There could be no practical difficulty in regulating the discharge into the Reservoirs so as to prevent all waste. The lower the level of the East Boston Reservoir, as compared with that of Brookline, the more easily would it be to draw the necessary supply at night and during those hours of the day when a reduction of head, for the high service of the City proper, would not be seriously inconvenient.

"That a maximum level considerably lower than that of the Brookline Reservoir should be adopted for that at East Boston is very evident, from the fact that the estimated supply for the City proper would require an average loss of head at Haymarket Square of $9\frac{67}{100}$ feet. This point is the proposed source for East Boston, for the supply of which, with 1,500,000 gallons per diem, an additional head of $6\frac{27}{100}$ feet for a 20-inch pipe would be required, making a total average head of $15\frac{94}{100}$ feet, say 16 feet."

They then state how they estimate the loss of head, and that they have no doubt that it would be easy to maintain the Reservoir at a much higher level, but that it would be of no practical utility, "and might in the end be productive of considerable disappointment to those whose arrangements had been made for receiving it at the highest level."

In speaking of the proposed Reservoir, they say: "Owing to the peculiar location of the only available site that can be selected for this Reservoir, being the crest of a narrow ridge, with a very steep northern slope, any material additional height, would render it very difficult, if not unsafe, to construct its banks entirely of earth, as at present proposed; and any change of plan from earth to masonry, in whole or in part, would be very expensive in proportion to the amount of masonry used."

In regard to the estimates, they say, "that very little change has been made in the items embraced in the previous estimates, the increased sum having been made up by the amounts added for greater perfection of the river crossings, for change of line to avoid land damages, for service pipes, and for removing the Reservoir far enough to the east to avoid a house; and by the further sum of $20,000, added to the previous estimates of the Water Committee for land damages.

The estimates, as revised, will stand thus:

| | |
|---|---|
| Bridge Work | $54,920 38 |
| Dredging | 2,500 00 |
| 4 Syphons, including cost of pipes | 30,000 00 |
| 21,870 feet of 20-inch pipe, at $6.00 | 131,220 00 |
| Contingencies | 43,728 07 |
| Reservoir | 50,000 00 |
| Service Pipes | 20,000 00 |
| Distribution by Main Pipe | 107,753 80 |
| Land damages | 40,000 00 |
| | $480,122 25 |

Aug. 13th, the Commissioners were instructed to proceed without delay in carrying the water of Long Pond to East Boston, according to the plans and estimates submitted by Messrs. Whitwell and Chesbrough in their Report of the 21st ult., with such modifications as may hereafter be suggested.

On the same day, they were authorized to expend the sum of $5,000 to introduce Cochituate water by means of a lead pipe into East Boston, to relieve its present wants.

The Committee, on December 31st, reported that it was inexpedient to further continue the term of office of the Water Commissioners, and recommended as a substitute, a WATER BOARD, consisting of one Commissioner, an Engineer, and a Water Registrar; and an Ordinance was passed, establishing the same, which provides in

Section 1, That all the rights, powers, and authority given to the City of Boston, should be exercised by the COCHITUATE WATER BOARD, and the joint Standing Committee on Water, under the direction of the City Council.

Section 2, provided that the Board should consist of a Commissioner, an Engineer, and a Water Registrar; that they should be chosen for one year, subject to removal by the City Council, and any vacancies that might occur should be filled by the City Council for the remainder of the term.

Section 3, provided that the members of the Water Board should receive such compensation as the City Council should determine.

Section 4, provided that the Water Board and the Joint Standing Committee on Water should have the control, care and management of all the works.

Section 5, provided for the election of a Water Comptroller.

Section 6, provided that all other officers and clerks should be appointed by the Water Board, with the advice and concurrence of the Joint Standing Committee on Water.

Section 7, provided that the Commissioner should be Chairman of the Board, and should have the general supervision.

Section 8, provided that the Engineer should prepare all plans of construction, and keep a record of all levels, distances, dimensions and positions of all pipes, mains and hydrants, make estimates, certify accounts, examine from time to time the works, and give notice to the Board of such repairs as may be deemed expedient.

Section 9, provided that the Water Registrar, by authority of the Water Board, should assess the Water Rates as established by the City Council, that he should visit the premises of every water-taker, and should issue all notices before the stoppage of water for repairs, for non-payment of water rates, or for other cause.

Section 10, provided that the Water Comptroller should keep the accounts of the Board, receive the water rents, and pay the same weekly to the City Treasurer, and audit all bills and contract payments, under the direction of the Water Board.

Section 11, provided that all the officers should be resident in the City.

Section 12, provided that the Joint Standing Committee on Water should visit the works once a year, to exercise a general oversight over the Water Board, and audit their annual account.

Section 13, provided that all bills, contracts, salaries and expenses should be paid by the City Treasurer in the same manner as other demands against the City are paid.

Section 14, provided that the Board should report, before the third Monday in March next, a working plan for the ensuing year, with an estimate.

Section 15, provided that they should make a Report, before the second Tuesday of December next, containing the receipts and expenditures in detail, with a statement of the condition of the works.

Section 16, provided that no opening, or connection with any pipe should be made without an order from the Water Board, and under their direction and control.

Section 17, provided that the Water Rent should be paid in advance for the year, in the month of January, and that special supplies and fractional parts of a year should be paid within thirty days after the letting on of the water in each case.

Section 18, provided that in case of non-payment of water rates, the Water Registrar should, after issuing general notice in the public prints, and special notice on the premises where the water is supplied, cut off the supply of water at such places, and the same should not be let on again until the payment of the amount due, together with the sum of one dollar and fifty cents.

Section 19, provided that the Water Board, in concert with the Chief Engineer of the Fire Department, should make all regulations for the use of the Fire Hydrants, and that in all questions relating to the same, the Chief Engineer of the Fire Department was to have equal authority with each of the Water Board.

Section 20, provided that this Ordinance should continue in force for one year and no longer, and could be altered, amended or repealed at the discretion of the City Council.

The Election of the Officers under this Ordinance, was made on January 4th, 1850, when E. S. Chesbrough was elected Water Commissioner, William S. Whitwell, Engineer, and J. Avery Richards, Water Registrar; and on the next day, Samuel Holbrook was elected Water Comptroller.

The proceedings of this Water Board for the year that they were elected, together with those of the present Board since its organization in January, eighteen hundred and fifty-one, to January, eighteen hundred and sixty-eight, will be found in PART THIRD. (City Documents on subject of Water, for year 1847, Nos. 3, 4, 5, 18, 24, 26, 29, 38, 41, 53, 57, 61, 63, 68.)

# PART SECOND.

PROCEEDINGS OF THE WATER COMMISSIONERS, UNDER THE ACT FOR INTRODUCING WATER INTO THE CITY, DURING THE CONSTRUCTION OF THE WORKS, FROM MAY 4TH, 1846, TO JANUARY, 1850.

# CHAPTER XI.

## 1846.

First meeting of the Water Commissioners — John B. Jervis elected Consulting Engineer — Samuel Holbrook elected Clerk — Land purchased for the Beacon Hill Reservoir — Price paid — Work divided into two Divisions — E. Sylvester Chesbrough elected Chief Engineer of Western, and William S. Whitwell, of Eastern Division — Surveying party organized — Purchase of Long and Dug Ponds — First purchase of brick for the Conduit — Survey of the first division of the Aqueduct — Contract awarded for excavation on the first division.— Ceremonies at the first breaking of the ground — Rooms engaged for the Commissioners — Agreement for Land of Charles Loker — Contract for Masonry on the first division — Change of route and location of Reservoir — Size of main Pipes — Contracts awarded for the excavation on the remaining sections — Commencement of the work — Purchase of White Hall Pond — Contracts awarded for Iron Pipes, and for constructing the Beacon Hill Reservoir — Taking of land for the enlargement of the Reservoir — Purchase of brick during the year — Work on the Tunnels — Engineers on the several divisions.

THE first meeting of the Commissioners, under the Act for introducing water into the city, namely, Messrs. JAMES F. BALDWIN, NATHAN HALE, and THOMAS B. CURTIS, was held on May 5th, 1846, the day after their appointment.

At this meeting, they had their first conference with Mr. William H. Knight, the owner of the outlet and dam at Long Pond; they also decided to engage the services of Mr. JOHN B. JERVIS, of New York, as CONSULTING ENGINEER, and a letter was sent to him asking an interview. At their second meeting, they elected Mr. Samuel Holbrook as Clerk.

May 15th, Mr. Jervis was engaged as Consulting Engineer, at a salary of $3,000 per year.

May 18th, through the agency of Mr. Thomas C. Smith, they purchased of Mr. John Hancock a lot of land for the Beacon Hill Reservoir; this lot did not front on any street, but was located in the rear of estates situated on Mount Vernon, Hancock, Derne and Temple streets, and contained 17,392 feet, and was bought for the sum of $35,876 or $\$2\frac{29}{100}$ per square foot.

On the 20th of May, Mr. Thomas S. Williams was engaged as Temporary Engineer to examine and make soundings from Long Pond to Morse's

Pond; and on the same day the Commissioners, in company with the Mayor, made their first visit to Long Pond and to Knight's Factory.

It was decided to divide the works into two Divisions, the *Western* Division to consist of all the works from Long Pond to the Brookline Reservoir, both inclusive; the *Eastern* to consist of all the works from Brookline Reservoir, including those within the City; and that each Division should be under the charge of a Chief Engineer.

On the 25th of May, they elected Mr. E. Sylvester Chesbrough as Chief Engineer of the Western Division, at a salary of $3,000 per annum; which office he accepted on the 27th.

On June 6th, Mr. William S. Whitwell was elected Chief Engineer of the Eastern Division, at a salary of $3,000 per annum; which he accepted on the 19th.

After these appointments were made, a surveying party was organized under the direction of the Chief Engineers to survey and definitely locate the line of the aqueduct, with a view of putting a portion of it under contract with as little delay as possible. This party consisted of an engineer, four assistant engineers, two levellers and nineteen subordinates.

On June 11th, after several interviews with Mr. Knight, and a careful examination of the premises, the Commissioners made a provisional arrangement with him for the purchase of the exclusive right to the waters of Long and Dug ponds, the two water privileges on the stream discharging therefrom, and also his manufacturing establishment, including the mills, buildings, machinery, fixtures and dwelling-houses occupied by operatives, for the sum of one hundred and fifty thousand dollars for the whole; or one hundred thousand dollars for all, excepting the manufacturing establishments, mills, buildings, etc. In the event of their taking the mills, etc., they were to put in a steam engine of sufficient power to carry the works, which they estimate would cost $10,000, and to lease him the premises, for the term of three years, for nine thousand dollars per year, taxes and repairs.

This agreement was made subject to the approval of the City Council. The Commissioners had some doubts as to their power to make such an arrangement, although they believed it to be for the interest of the City. They accordingly sent, on the 15th of June, a communication on the subject to the City Council, who, on the 17th of June, gave authority in the matter to the Standing Committee on Water, as mentioned in Part I., Chapter VII. A copy of the deed on this occasion, as well as of all other deeds of lands purchased in connection with the Water Works, can be found upon record at the office of the Water Board, City Hall, Boston.

On the 20th, Edward Mellen, Esq., of Wayland, was requested to examine Mr. Knight's title to the lands, waters, buildings, etc. The first payment on account of this purchase, amounting to $50,000, was made June 25th. The Commissioners took possession of Mr. Knight's property, under the Act, on the 10th of August; and the final payment of $100,000, and the delivery of the deed, took place August 13th. This deed given by Mr. Knight contains a full description of all the land and buildings taken, and a release from all damages; the lease from the City to Mr. Knight was passed on the same day.

During the month of July, the first Division of the Aqueduct extending from Long Pond to the road leading from Newton Lower Falls to East Needham, a distance of five and a half miles, was surveyed, and was fully prepared for contracts, with the levels, plans and profiles given. This Division was sub-divided into four sections, and proposals for excavation and grading were received on each; which proposals were opened and awards made, August 3d, as follows: The First, Third and Fourth Sections to Carmichael, Gonder & Co.; first section at 18 cents, third at 15 cents, and the fourth at 16 cents, per cubic yard. The second section was awarded to Francis Blair at 17 cents per cubic yard.

THE FIRST BREAKING OF THE GROUND FOR THE CONSTRUCTION OF THE AQUEDUCT WAS MADE AT THE POND, AUGUST 20TH, 1846.

A finer day could not have been selected for the purpose. The City Government, Commissioners and invited guests, with music, left the City in a special train by the Worcester Railroad at 10 o'clock, and on their arrival opposite the Pond, a procession was formed under the direction of Mr. S. D. Seaverns, and marched to it. Immediately behind the Mayor, JOSIAH QUINCY, JR., was borne the Spade to be used on the occasion; it was carried by Master William Henry Dutton; and on the arrival at the point selected for the commencement of the work, Alderman Parker presented the Spade to the Mayor, with a few appropriate remarks.

Mr. Nathan Hale next addressed the Mayor, and in the course of his speech stated that the Commissioners were desirous of meeting the City Council on the borders of the Pond itself for the purpose of receiving their co-operation in striking the first blow towards the accomplishment of the great enterprise of introducing a copious supply of water into the City, and he invited the Mayor to take the first step in its progress.

The Mayor replied at some length, and, at the conclusion of his remarks, took off his coat, and dug the first spadeful of earth, which he deposited in

a wheelbarrow provided for the purpose. This act was greeted with loud and long cheers, and the band struck up "*Hail Columbia.*"

The Mayor, with a few appropriate remarks, then called upon JOHN QUINCY ADAMS, late President of the United States, to throw the second spadeful; whereupon he took off his coat, amid the cheers of the people, and deposited the second spadeful in the barrow, the band playing "*Adams and Liberty.*" The third spadeful was then thrown by JOSIAH QUINCY, Sen.

The spade used on the occasion is now in possession of the Cochituate Water Board, at their office in the City Hall, and bears the following inscriptions engraved on silver plates.

ON THE FACE.

WITH THIS SPADE THE FIRST EARTH WAS REMOVED IN CONSTRUCTING THE LONG POND AQUEDUCT BY HON. JOSIAH QUINCY, JR., MAYOR OF BOSTON, AUGUST 20, A.D. 1846 IN THE PRESENCE OF THE CITY COUNCIL, AND OTHER INVITED GUESTS.

PRESENTED AS A MEMORIAL OF THE EVENT BY THE WATER COMMITTEE.

ON THE REVERSE.

*Water Commissioners,*

NATHAN HALE, ESQ., JAMES F. BALDWIN, ESQ., THOS. B. CURTIS, ESQ.

*Water*
JOSIAH QUINCY, JR.
WM. PARKER,
WM. POPE,
Of the Board of Aldermen.

*Committee.*
LORING NORCROSS,
JAMES WHITING,
JAMES HAYWARD,
HENRY W. DUTTON,
SAMUEL W. HALL,
Of the Council.

LAKE COCHITUATE.

The original name restored by vote of Council, Aug. 20, 1846.

After a few remarks by Mr. Gonder, one of the contractors, the procession was again formed, and marched to the pavilion where dinner was provided by Mr. J. B. Smith; a blessing was offered by the Rev. R. C. Waterston, and at the conclusion of the dinner, addresses were made by the Mayor, Thomas B. Curtis, John Q. Adams, G. S. Hillard, Josiah Quincy, Sen., James T. Austin, John G. Palfrey, James G. Green, and others.

At the conclusion of the addresses, the party returned to the City, rejoicing that the great work had been commenced.

On August 22d, the Commissioners made an agreement with Mr. Charles Loker for his land at the head of the Aqueduct, and for several other lots on

the margin of the Pond, and on the line of the Aqueduct, for fifty dollars per acre; and for the Island, or young woodland, at one hundred dollars per acre.

September 17th, a contract was made with Mr. Gonder, for Carmichael & Co., to do all the masonry of the brick Aqueduct for the First Division of the line, they to find all the materials except the brick, which were to be delivered at convenient points along the line, at two dollars per lineal or running foot of Aqueduct. This was afterwards changed, on account of the nature of the work, to the following prices, Section 1, $2.46; Section 2, $2.45; Section 3, $2.43½; Section 4, $2.44; Section 5, $2.41; and the first brick was laid, under this contract, October 19th.

Several surveys having been made for the location of a Reservoir in Brighton or Brookline, the Commissioners on the nineteenth of September, decided upon the present location in Brookline.

In reference to this decision they say, in their Report to the City Council, on the 24th of September, "they have within a few days past come to the important decision of adopting a route through Newton, and Brookline, which will require the excavation of two tunnels, one 2,300 feet, and the other, 1,150 feet in length, and the establishment of a Reservoir near the residence of John E. Thayer, Esq., in Brookline. The advantages of this route over that which was indicated by the earlier surveys, terminating at Corey's Hill, it is believed, are more than sufficient to countervail the cost of tunnelling. These consist of a material shortening of the distance, the dispensing with the necessity of a pipe communication across the Brighton Valley, the obtaining of a more capacious and eligibly situated Reservoir, at a slightly increased distance from the City, a higher elevation in consequence of dispensing with the pipe communication at Brighton, and a saving on the amount of damages to the estates passed through, in consequence of the secluded tract of country, and the inferior value of the lands through which the route passes."

It was also decided on the same day, that the two main pipes should be each thirty inches diameter: subsequently, one of them was changed to a thirty-six inch.

The Estimates for the excavation of the remaining division of the line were sent in on October 12th; and on the 14th, the contracts were awarded as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Section | 5, | at | 9¼ | cents | per | cubic | yard, | to Martin, Magee & Co. |
| " | 6, | " | 11 | " | " | " | " | " John Healey & Co. |
| " | 8, | " | 9 | " | " | " | " | " J. H. Bollins & Co. |
| " | 9, | " | 10¼ | " | " | " | " | " Ebenezer Lobdell & Co. |

Section 10, at 15 cents per cubic yard, to Edward Learned & Sons.
" 11, " 18 " " " " " " " " "
" 12, " 14 " " " " " " " " "
" 13, " 20 " " " " " " " " "
" 14, " 15 " " " " " " " " "

Sections 11 and 13 included the two tunnels.

The laying of brick upon Section 4, first division, was commenced on the 19th of October and continued until the latter part of November, when the work was suspended until Spring. The inverted arch was meantime filled with earth to prevent injury from frost.

The purchase of White Hall Pond, in Hopkinton, was made November 4th, by the Committee on Water, under the resolve passed April 21st, Part I., Chap. VII., for the sum of $25,000, with the intention of using it as a Compensating Reservoir to flow into the Concord River as a substitute for Long Pond water, whenever that should be diverted from its natural channel to the injury of those who were entitled to the use of it. This pond at high-water mark, had an area of 576 acres, and a water-shed of 2,840 acres. At the time of its purchase, it was owned by William B. and A. Wood, who leased the same for the sum of $1,500 per year, until required by the City. The actual cost of this Reservoir, after the dam was built and the improvements made, was $29,534.36.

The first contracts for Iron Pipes were made November 16th, with the following parties: 2,440 tons, 30-inch, from Cyrus Alger & Co. and the West Point Foundry, one-half by each, at $47.50 per ton; 550 tons 12 and 16 inch, from Leonard Fuller, at $47.00 per ton; 1,570 tons, 4 and 6 inch, from A. M. & B. W. Jones, and Messrs. Colwell & Co., of Philadelphia, at $45.00 per ton; 2,240 lbs. to a ton.

The contract for constructing the Beacon Hill Reservoir was awarded to Messrs. Edward Learned & Sons, and Carmichael, Gonder & Co., December 5th, they agreeing to complete the work by August 1st, 1848; several days were occupied in the examination of the twenty bids which were received. This is the contract which caused the dissatisfaction mentioned in Part I. Chap. VII. Before this contract was made, which was executed in the name of Gonder, Case & Co., it was decided by the Commissioners to enlarge the Reservoir by taking a lot of land on Hancock and Derne streets, belonging to Benjamin Adams, and to make application to the Legislature for the purchase of a lot on Hancock Street, owned by the Commonwealth. December 19th, the tenants, seventeen in number, on the estate of Mr. Adams, were notified to vacate within three months, the Commissioners having

taken possession of the premises under the act of the Legislature. Mr. Adams was notified of the taking, on the same day.

Between July 1846, and January 1847, over 8,000,000 of bricks were contracted for at $5\frac{1}{2}$ per. M., for those delivered in Boston, and $7\frac{1}{2}$, for those delivered on the line of the Aqueduct. Mr. Joseph Parker, was engaged to examine the bricks when delivered, as to quality and quantity, and report daily to the office of the Commissioners.

Mr. Nathaniel Chamberlain was appointed Superintendent of the Beacon Hill Reservoir.

It should have been mentioned, that the work on the TUNNELS was commenced by sinking shafts about four hundred feet apart; those on the Newton tunnel were commenced November 15th, and those on the Brookline, December 17th; and the first drift on the west end of the Newton tunnel was commenced December 30th, 1846.

The line of the Conduit, from the Lake to the Brookline Reservoir, was divided into three divisions; the first, commencing at the lake, was 30,083 feet long, and under the charge of T. E. Sickles, as Resident Engineer, assisted by M. Conant, William E. Furguson, and G. H. Hyde. The second, 26,453 feet long, was under the charge of H. S. McKean, as Resident Engineer, assisted by J. J. Spooner and S. S. Greele. The third, 23,000 feet long, including the Tunnels and Reservoir, was under the charge of T. S. Williams, as Resident Engineer, assisted by F. J. Williams, G. A. Williams, and J. C. C. Hoskins.

The Property conveyed to the City by Mr. Knight, in the deed before referred to, was as follows:

His right and title to Long and Dug Ponds, situated in the towns of Natick and Framingham, together with several tracts of land, as deeded to him by the former proprietors of said property; also, the several tracts of land lately purchased by him, on the borders of Long Pond, from the following persons:

| | | | |
|---|---|---|---|
| John Travis and Edward Hammond, Jr., | by deed | dated | July 31st, 1844. |
| Eunice and Roxaline Marshall, | " | " | July 31st, 1844. |
| Lucinda Colburn, | " | " | June 28th, 1845. |
| Sybell Marshall, | " | " | October 25th, 1845. |
| William Coolidge, | " | " | April 12th, 1845. |
| Timothy Bullard, Jonas and Mary Loker, | " | " | August 5th, 1844. |
| Eleazer G. Wright, | " | " | August 5th, 1844. |

| | | | |
|---|---|---|---|
| Moses Fiske, Jr. and Aaron Fiske, | by deed | dated | August 3rd, 1844. |
| Jonas Goodnow, | " | " | July 24, 1845. |
| Charles Loker, | " | " | August 26th, 1844. |
| Winthrop Loker, | " | " | June 28th, 1845. |
| Patty, Olive N. and Sarah Bacon, | " | " | April 30th, 1845. |
| Sylvester W. Warren, | " | " | August 20th, 1845. |
| Jedediah Washburn, | " | " | September 23d, 1844. |
| John Travis, | " | " | August 30th, 1844. |

Also, the following deeds, which were included in his purchase from the Framingham Manufacturing Company.

| | | | | | | |
|---|---|---|---|---|---|---|
| Moses Fiske, | to said | company, | by | deed | dated | October 16th, 1821. |
| George Whiting, | " | " | " | " | " | September 30th, 1822. |
| James Brown, | " | " | " | " | " | March 23d, 1812. |
| Lemuel Fiske, | " | " | " | " | " | June 20th, 1822. |
| Josiah Rice, | " | " | " | " | " | June 30th, 1806. |
| Jonas Goodnow, | " | " | " | " | " | June 6th, 1829. |
| Collins, and Isaac Damen, | " | " | " | " | " | October 16th, 1829. |
| Jedediah Washburn, | " | " | " | " | " | December 4th, 1821. |
| Moses Fiske, | " | " | " | " | " | November 1st, 1823. |
| George Whiting, | " | " | " | " | " | November 1st, 1823. |
| Calvin Haven, | " | " | " | " | " | November 5th, 1823. |
| Jedediah Washburn, | " | " | " | " | " | April 7th, 1822. |
| Dorothy Hall, | " | " | " | " | " | May 12th, 1823. |
| Saml. Fiske, | " | " | " | " | " | May 6th, 1822. |
| John Bacon, Adm'r, | " | " | " | " | " | August 22d, 1827. |

And one Factory building, situated at the upper privilege, so called; this building was eighty-three feet long, by thirty-three feet wide, three stories high, and filled with Worsted and Woollen Machinery, in full operation.

Also, two large dwelling-houses, with six acres of land, with outbuildings.

Three dwelling-houses, at the middle privilege, so called, with about one acre of land.

And, at the lower privilege, so called, one Factory, one hundred and forty-seven feet long by thirty-three feet wide, three stories high, with three large additions; and all fitted with machinery in complete working order.

Also, one other Factory, one hundred feet long, by thirty-three feet wide, and three stories high, filled with carpet looms; one Dye House, and three Drying Houses; all fitted for operation.

There were also Wash-houses, Bleacheries, and a Manufactory for making Soap, together with six acres of land.

The Machinery contained in the above-named factories was considered sufficient for the manufactory of fifteen hundred yards of carpeting per day.

# CHAPTER XII.

## 1847.

Application to the Legislature for the purchase of House on Hancock Street — Notice to the City Government — Brookline Tunnel — Acceptance of proposals for building the Conduit — Factories burnt — Purchase of Benjamin Adams' Estate — Work of laying the Iron Pipes commenced — Beacon Hill Reservoir enlarged — Estates purchased for the Reservoir — Origin of the name, Beacon Hill — First purchase of Land for the Brookline Reservoir — Mr. Hale's objection to the purchase of the Thayer lot — Award of the referees on the Thayer lot. Estates purchased for the Brookline Reservoir — Route to South Boston decided upon — Accident at the Beacon Hill Reservoir — Corner-stone of the Beacon Hill Reservoir laid — Compensating Reservoirs.

On January 12th, 1847, the Commissioners made application to the Legislature, through the Hon. John C. Gray, for the purchase of the estate on Hancock Street, as mentioned in the preceding Chapter, which was referred to a Committee, who recommended the sale for the sum of $13,000. This the Commissioners thought too much, and offered $10,000, but no abatement was made.

Notice was sent to the City Government, on the 22d of January, of the intention to build the Beacon Hill Reservoir, and that the laying of the iron pipes would be commenced as soon in the Spring as the frost was out of the ground, with the request that if the grade of Tremont Street was to be changed, they might be notified at once.

January 30th, the first drift on the Brookline Tunnel was commenced, and for the purpose of ensuring the completion of the two tunnels within the time that would be required for the execution of the other branches of the work, it was continued night and day without interruption, by successive working parties, relieving one another every eight hours. For further expediting the work, seven shafts were sunk through the rock in the Newton Tunnel, and three in the Brookline; it was also found necessary to keep

seven steam engines in constant operation to pump the water that was encountered.

Proposals having been received for the several portions of the work, on the 16th of March they were opened, and the following bids accepted.

For Stone Masonry, Bulk Head, and Gate Chamber at the Pond, from Carmichael, Gonder & Co.; this contract was afterward given up and the work done by the day. Bridge over Charles River, and Stone Structures on Section 6, from Clark, Christy & Co. Waste Weirs and Stone Culverts, on Sections 10, 11, 12 and 13, to Clark, Christy & Co.; this contract was afterwards transferred to Bryant, Blaisdell & Co., who completed the work.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Brick Conduit on Section | | | 6 | from | S. McCullough, | at | $2.26 | per lineal | foot |
| " | " | " | 8 | " | Jas. & Chas. Collins | " | $2.26 | " | " |
| " | " | " | 9 | " | Clark, Christy & Co. | " | $2.25 | " | " |
| " | " | " | 10 | " | S. McCullough | " | $2.35 | " | " |

The contract for Section 10 was afterwards transferred to C. C. Morrison.

Brick Conduit on Sections 12 and 13 from Shippey, Kimball & Co., at $2.09 and $2.08 per lineal foot.

After these contracts were awarded, the Commissioners appointed Mr. Edward F. Knowlton as Inspector of work, whose duty it was to examine the work as laid, and to report daily at the office of the Commissioners.

On the morning of March 20th, the following note was received by the Commissioners.

SATURDAY MORNING.

GENTS,—I am sorry to inform you that the two Carpet Factories have been destroyed by fire this morning. All had been regular respecting fires and lights. Nothing done which could injure the Insurance.

Yours, in haste,

(Signed,) W. H. KNIGHT.

These Factories were insured for the benefit of the City to the amount of $17,500, which was paid in full; there was also received from the sale of old materials and machinery $8,556.92, and from rents $4,900, also on account of the sale of land, on which the Factories stood, the sum of $4,124.86.

As the Commissioners could not agree with Mr. Benjamin Adams upon the value of his Estate on Hancock and Derne streets, application was made to the Court, May 5th, 1847, to appoint a commission to assess his damage, but before the appointment, a settlement was made upon his terms,

viz, $25,000, and interest from the day of taking. The buildings upon the lot were sold April 9th, to be removed in ten days.

On the morning of Monday, April 19th, the work of laying the Iron pipes in the City was commenced, three separate parties being employed for this purpose in different sections of the City; the whole being under the direction of W. S. Whitwell, the Chief Engineer of the Eastern division, who was assisted by George H. Bailey, James Slade, James F. Sheppard, Charles Perkins, Frederick Budden, Frederick Tuttle, and N. H. Crafts.

The laying of pipes was continued, as expeditiously as possible, until December 17th, 1847, when the work was suspended for the winter. Previous to the middle of July, over eight miles had been laid.

On May 14th, it was decided to further enlarge the Beacon Hill Reservoir, by including the houses on Temple Street owned by H. W. Kinsman, Benjamin R. Curtis, Charles P. Curtis, and Charles T. Russell; also, the Bowdoin Public School-house on the corner of Temple and Derne streets; and the tenants were notified to vacate the premises within thirty days.

The cost of the estates purchased for the location of this Reservoir were as follows:

| | |
|---|---|
| Estate of John Hancock, in the rear of the other estates . | $35,876 62 |
| " " Benjamin Adams, on Hancock and Derne Streets . | 25,725 00 |
| " " Commonwealth of Massachusetts, on Hancock Street, | 13,000 00 |
| " " H. W. Kinsman, on Temple Street . . . | 8,615 00 |
| " " Benjamin R. Curtis, on Temple Street . . | 15,000 00 |
| " " Charles P. Curtis, on " " . . | 10,350 00 |
| " " Charles T. Russell, on " " . . | 8,647 33 |
| " " City of Boston, corner of Temple and Derne streets | 30,000 00 |
| Total . . . . . | $147,213 95 |
| Less Cash received for old materials sold . . . . | 2,106 85 |
| Cost of land . . . . . | $145,107 10 |

The Commissioners in speaking of the site for this Reservoir in one of their Reports to the City Council say: "This Hill derived its name from a Beacon which was erected upon its summit, at an early period of the history of the town. This Beacon was blown down in the year 1789, and in its place was erected a Doric Column 60 feet in height, with an inscription on its pedestal in commemoration of the prominent events of the War of the Revolution. The site of this Monument was within the limits of the ground occupied by the Reservoir, but the base of the Monument was at an elevation

of more than seventy feet above the foundation of the structure as now laid. The Hill being too high and steep to be occupied by dwelling-houses it was dug away and the Monument taken down."

In speaking of the difference of the level of water in the Beacon Hill and Brookline Reservoirs, they say: "It must be apparent that, at whatever height the water may be at Brookline, it must, when flowing, be at a lower level on Beacon Hill. The difference in the height of water in the two Reservoirs will increase or diminish, as the supply and discharge may vary."

The first payment on account of the purchase of land for the Brookline Reservoir, was made June 8th, to J. C. Clark and daughters. Several estates were afterwards purchased, and it was finally decided to include a portion of the estate of John E. Thayer; Mr. Hale dissenting, "on the ground that, in his opinion, a Reservoir of an area of sixteen acres, twelve feet in depth, unless where the present surface of the ground will give a greater depth, would be ample for all the uses for which it would be required at any future day, under any supposable extent of demand for the water, and for any quantity which the Aqueduct is capable of affording; that the land already purchased, and that proposed to be taken, embraced in the Clark, Hayden and Heath estates, is exactly adapted to the forming of a Reservoir of these dimensions, and of a convenient and tasteful form, by merely shaping the surrounding bank to make it correspond nearly with the natural surface of the earth on all sides except one, and with but a moderate expense for excavation; and that the enlargement of the Reservoir, by embracing in it the land of Mr. Thayer, will enhance the cost, not only by the price of the land so taken, but by the increased expense of a much more extensive embankment without any additional benefit."

The Commissioners being unable to agree with Mr. Thayer as to the value of his land taken, about five acres, and as to the damages to the rest of his estate, it was referred to Edw. H. Robbins, Thomas H. Perkins, Jr., and John L. Gardner, who made their award July 8th, amounting to $22,500.

The estates purchased for the location of this Reservoir, were as follows:

| | | |
|---|---|---|
| From Joshua C. Clark, and daughters, | . . . | $10,201 69 |
| " Charles Heath, | . . . . . | 8,107 75 |
| " John C. Hayden, | . . . . . | 4,609 50 |
| " Heirs of David Hyslop, | . . . . | 12,999 99 |
| " John E. Thayer, | . . . . . | 22,500 00 |
| Total for about thirty acres, | . . . | $58,418 93 |

During the month of August, several routes were surveyed for carrying the main pipe to South Boston, and it was finally decided on the 30th, to adopt the Dover Street route, in preference to that through Roxbury and Dorchester. It was also decided that one of the main pipes from Brookline Reservoir should be 36 inches diameter from the Reservoir to Dover Street.

The foundation for the Beacon Hill Reservoir being nearly completed, it was decided to lay the Corner Stone on the 13th of November, at 12 o'clock; but at half past eleven, the ring at the head of the mast of the derrick to which the stone was suspended gave way, slightly injuring a little boy, and breaking the leg of a little girl, by the name of Frances Maria Hobbs, and doing considerable damage at the works. The laying of the stone was consequently postponed.

On the morning of November 20th, a Procession was formed at the City Hall under the direction of Francis Tukey, the City Marshal, consisting of the City Government, the Commissioners, Contractors and invited guests, preceded by a band of music, and marched to the site for the Reservoir on Derne street, where the Corner Stone was duly laid. Prayer was offered by the Rev. N. Adams, and an Address was made by the Mayor, Josiah Quincy, Jr. A copper box 12 inches square and 6 inches deep was deposited in the stone; it contained some of the publications of the day, the various Reports on Water, and two silver plates; on one was engraved the following inscription: "The Water Commissioners deposit this testimonial of respect for the memories of the late Loammi Baldwin, Martin Brimmer, Thomas A. Davis and Patrick T. Jackson, who severally rendered important assistance in promoting the adoption of the plans for a perpetual supply of pure water to the Citizens of Boston." On the other plate were engraved the names of the City Government, Water Commissioners, Water Committee, Engineers and Contractors.

The Corner Stone is situated on the corner of Temple and Derne streets, the box being let into the upper part of the base at the angle.

A Report was sent to the City Council, Dec. 13th, by the Water Commissioners, recommending that, in addition to the White Hall Pond Reservoir, already purchased by order of the City Council, they should receive power to purchase other water rights for the purpose of forming COMPENSATING RESERVOIRS, as they did not deem it prudent to rely solely on the one purchased; an Order was accordingly passed as mentioned in Part I. Chapter VIII.

During this year, 1847, the Commissioners settled for, and received deeds of over sixty pieces of land on the borders of the Lake and on the line of the Conduit.

# CHAPTER XIII.

## 1848.

Death of the Superintendent of Beacon Hill Reservoir — Appointment of his Successor — Purchase of the Marlboro' Reservoirs — Cracks in the Conduit — Agreement with the Selectmen of Brookline — Difficulty in building the Conduit in the first and second Sections — Newton and Brookline Tunnels completed — W. C. Barstow's offer to carry a Pipe to East Boston — Mr. Jervis' term of office extended — Main Pipes from the Brookline Reservoir to Dover Street — Number and weight of the same — Land purchased for the South Boston Reservoir — Pipe over the Boston and Worcester Railroad Bridge — Location of the Fountain on the Common — Accident in the Newton Tunnel — Conduit finished — Water let into the Conduit and the iron Pipes — Extract from Mr. Hale's Address at the Water Celebration — Water let into the Service Pipes and into the Brookline Reservoir — Fracture in the Iron Pipe.

Mr. Nathaniel Chamberlain, who has been spoken of as the Superintendent of the Beacon Hill Reservoir, left for Virginia on January 20th, for the benefit of his health, and died there on February 29th, 1848. The Commissioners, in speaking of his death, said that they had lost an intelligent and skilful agent, to whose watchful care was committed the important trust of procuring a firm and durable foundation for that structure, and upon whom they had relied for insuring a thorough execution of the whole work. Mr. Charles Pratt, of Cohasset, was afterwards appointed to fill the vacancy.

In the early part of this year, 1848, the Commissioners were occupied in negotiating for land taken, and in making their arrangements for the energetic prosecution of the work in the Spring; also, in making contracts for iron pipes of various sizes for the distribution in the City. The only work that was continued through the winter was on the two tunnels in Newton and Brookline.

January 13th, 1848, the Commissioners purchased of Mr. Amory Maynard the Marlborough and Boon Pond Reservoir, for the sum of $21,148.90; they finally cost, however, when the dam was completed and the Reservoir ready for use, $43,170.59.

In the month of March, when the Conduit was opened for the Spring work, several cracks were discovered in the fourth section of the first division. The engineers were instructed to make an examination, and report to the Commissioners the cause of the same. In their Report, they say: "They do not consider that the cracks were caused by any defect of construction, but from the uneven settlement of the ground, and recommended that the cracks should be thoroughly pointed up," which was done.

March 16th, the Commissioners having encroached upon the road with the embankment of the Brookline Reservoir, they agreed with the Selectmen to pay to the town of Brookline, the sum of $1,000, on condition that the streets through Bradley's Hill should be lowered not less than four feet, on or before the 15th day of June next, and on the further consideration, that the City of Boston should be saved harmless against any claims for damages, for encroachment upon the said road, to the extent indicated on the plan of the Reservoir as now laid out.

The Commissioners in their Report of April 1st, in speaking of the Conduit, say: "The Conduit yet to be laid in Sections 1st and 2d, embracing the unlaid portion within the first 12,000 feet from the lake, will probably be the last to be finished, owing to the quicksand and water with which the workmen have to contend. This is a difficult part of the work, and although practicable, it will necessarily be expensive, and slow in its progress."

April 28th, the workmen in the drifts, from the two ends of the Newton Tunnel, brought their works together, which was the occasion of great rejoicing. The same event took place in the Brookline Tunnel on June 26th.

During the month of April, Mr. W. C. Barstow offered to carry a 12-inch iron pipe upon the bed of the river to East Boston, deep enough to clear any anchors, for the sum of $108,000. Mr. Barstow had several interviews with the Commissioners and Engineers upon the subject, but as he was unable to convince them of its practicability, his offer was not accepted.

On May 15th, Mr. Jervis sent a note to the Commissioners, stating that the two years for which his services were engaged had expired, and asking if they wished to continue the engagement; and it was thereupon voted, that he be requested to retain his office of Consulting Engineer until the introduction of the water into the City.

In the monthly Report of June 1st, in speaking of the two main pipes, the Commissioners say: "The parallel main pipes of 30 and 36 inches interior diameter, leading from the Reservoir in Brookline, through the streets in Brookline and Roxbury, to Dover Street in Boston, a distance of $3\frac{2}{3}$ miles, are now being laid as fast as the supply of pipe and a reason-

able regard to economy and the accommodation of the public travel will permit. This branch of the work, the parallel mains, is in some degree difficult and rather expensive, but it is to be considered that for the above distance of $3\frac{2}{3}$ miles there will be laid, when the work is finished, 2,284 pipes of three feet diameter, and a like number of 30-inch diameter, making an aggregate quantity of 7,728 net tons, with nearly 90 lbs. of lead to each joint. The cost of materials with the rock and earth excavations, and laying the double row of pipes in the same trench, must be heavy, and will make a large item in the whole expenditure upon the aqueduct."

The first purchase of land for the South Boston Reservoir was made June 23d, of Jonathan Phillips. The several purchases made for the location of this Reservoir were as follows:

| | | |
|---|---|---|
| From Jonathan Phillips, for the sum of | . . . . | $35,601 42 |
| " John M. Mayo, " " " " | . . . . | 5,645 70 |
| " Charles Ewer, " " " " | . . . . | 5,618 00 |
| " F. Nickerson, and others, for the sum of | . . . | 4,287 20 |
| " Jos. Nickerson, " " " " | . . . | 995 91 |
| " The United States, " " " " | . . . | 2,955 00 |
| Total cost of land | . . . . . | $55,103 23 |

In reference to the pipes crossing the Boston and Worcester Railroad Company Bridge, on Tremont street, they say: "It is proposed to cross this bridge in a box of boiler iron of sufficient dimensions and strength to receive and support these pipes, extending from one abutment to the other, under the westerly sidewalk of the Railroad bridge." In the same Report, they also say: That they have given attention to the placing of a Fountain upon the Common, and have decided upon using the pond nearly in the centre of the ground as a receiving basin, thus avoiding the expense of making one elsewhere, as well as the occupancy of other ground, and the interference with existing paths.

The brick work in the Newton tunnel was completed August 27th, and in the Brookline one, August 30th. A serious accident occurred during the construction of the Newton tunnel, by an explosion which injured several workmen, one of whom, named Dennis Casey, lost both hands.

September 17th, the entire bottom of the brick work of the Conduit was united; and, October 2d, the top was closed. Several days were occupied in pointing up and cleaning it out; and OCTOBER 12th, at 10 o'clock and forty-two minutes, A. M., THE WATER WAS LET ON for the first time. At three

o'clock, P. M., it had reached Charles River, and at half past three, it had crossed the river and valley, and was well on its way to Brookline; at four o'clock, the water was eighteen inches deep in the Conduit on the east side of Charles River, and at nine o'clock and ten minutes, in the evening, it reached the Brookline Reservoir, having been ten hours and twenty-eight minutes on its way from the Lake to the Reservoir.

ON THE 14TH OCTOBER, at eleven o'clock and fifteen minutes, A. M., the water was let into the small Conduit, situated in the northerly embankment of the Brookline Reservoir, and from thence IT PASSED INTO THE CITY through the 30-inch main pipe TO THE FOUNTAIN ON THE COMMON, where it arrived at two o'clock and five minutes, P. M., having been two hours and fifty minutes on its way from the Reservoir, or twelve hours and eighteen minutes from the Lake.

As everything was now ready for the PUBLIC INTRODUCTION OF THE WATER INTO THE CITY, the City Council were notified to that effect, and the 25th of October, 1848, was agreed upon for the CELEBRATION, an account of which has already been given in Part I., Chapter IX. We make, however, the following extract from Mr. Hale's Address on that occasion: "The waters of this lake have flowed for ages through a remote part of the country to the ocean. Their natural outlet is now forever closed, and a new channel has been formed, by the excavation of the intervening barrier of earth and rock, for conducting them, by gentle declivity, to the City. Through this channel, a covered Aqueduct of brick masonry has been built, to receive the flow of a uniform current, sufficient to supply the wants of the City, even should its population become double its present numbers.

"This Aqueduct, instead of inviting admiration like some of the works of ancient art, constructed for a similar purpose, is almost concealed from view by the earth which has been replaced over it, and the public will be left to judge of its magnitude and difficulty, and of the labor and skill required in its accomplishment, chiefly from a computation of its cost. Its value, however, will be measured by the degree in which it shall accomplish its purpose.

"In those parts of the work which are exposed to view, it was decided to adopt a style of architecture, severe and simple, indicative of a prudent economy, but at the same time such as would not degrade the character of a great public work, or give offence even to a fastidious taste."

The day after the celebration, the Fountain on the Common was played during the entire day; and on the 31st, the WATER WAS LET INTO THE SERVICE PIPES for the first time, to the great joy of all who had their fixtures prepared.

November 16th, the Commissioners with the Mayor, City Council and invited guests, went to Brookline to see the water let into the Reservoir for the first time. Soon after their arrival, the stop-planks were removed, and the water came gushing forth amid the cheers of the people. It soon became turbid, from the nature of the materials of which the bottom and banks of the Reservoir were composed, and it was left to clear itself by settling, while the supply for the citizens was continued through the small Conduit. In a few weeks, the water in the Reservoir was perfectly clear; it was let into the pipes, and the use of the small Conduit was discontinued.

After the water had been let on, there were several fractures on the line of the iron pipes; the most serious were the bursting of two large stopcocks, and that of one of the Y branches, owing probably to the sudden stoppage of a quick current of water, and a comparative weakness, caused by a change of form in the pipe from the cylindrical to a flattened or rectangular section. One of the large 30-inch pipes was soon afterwards cracked from some unknown cause.

# CHAPTER XIV.

## 1849.

Resignation of Mr Jervis — Reply of the Commissioners to the question as to whether the South Boston Reservoir could be dispensed with — Petition to have a Tower placed on Beacon Hill Reservoir — Reply of the Commissioners — Water ordered to be carried to East Boston — Temporary Pipe laid — Pipe broken by the Anchor of a Schooner — Land purchased for a Reservoir in East Boston — Water let into the Beacon Hill and South Boston Reservoirs — Claims for damages on account of the construction of the Newton Tunnel — Newton Aqueduct Company organized — Property of the Company — Agreement between the City of Boston, and the Aqueduct Company — Water for Fountains — Amount paid the principal Contractors — Amount paid by the Commissioners.

THE introduction of the water into the City being the limit of time for which Mr. Jarvis had accepted the office, he resigned his position as consulting Engineer, January 1st, 1849, as he did not consider that he could render any further assistance. On the 4th, the Commissioners sent a letter, thanking him for his valuable services, and acknowledging the great assistance he had rendered to them and to the Chief Engineers.

The Mayor having submitted to the Commissioners the question of dispensing with the Reservoirs on Telegraph Hill, they replied, March 6th, "that in their opinion it constitutes a beneficial part of the system of the distribution for the City; it is essential to the adequate and permanent supply of South Boston, and it would be false economy to postpone its construction to a future date." "The grounds upon which the Commissioners decided to establish this Reservoir in South Boston were, that the Beacon Hill Reservoir was too small to serve all the purposes for which it is designed, if relied on for the supply of the whole City; that a larger Reservoir in the old part of the City could not have been built but at a much greater cost than that by which an equal supply can be obtained at South Boston; and for the supply of South Boston itself, Telegraph Hill is the situation best adapted, not only on

account of its vicinity to the houses to be supplied, but on account of the resource which it would afford in case of an interruption of the supply.

"Although efforts have been made to protect the pipe which conducts the water across the channel at South Boston Bridge, it must be regarded as the most vulnerable part of the system of distribution. It is, therefore, fortunate that land for a large Reservoir, at so eligible a point as Telegraph Hill, can be obtained at a moderate cost, compared with the value of land in the heart of the City, where a supply will be provided for South Boston for a period of some days, in the contingency of a failure of the pipe which crosses the bridge and channel: that the same Reservoir, while the ordinary connection with the City is maintained, will be made subsidiary to that on Beacon Hill, in serving all its purposes; and that all these advantages may be obtained at a moderate cost, compared with that of a Reservoir of equal height and capacity in any other part of the City."

The amount of land required for this Reservoir was 126,000 square feet, which was purchased of the parties mentioned in the previous chapter; the balance of the lot forming the Hill was purchased by the City for a Square, and in April, an exchange was made with the City of a portion of the land purchased for the Reservoir, for a portion of that bought for a Square; the object being to obtain a better form and appearance for both.

Several citizens being desirous that a Tower should be erected on the top of Beacon Hill Reservoir, and Moses Grant having sent a letter to the Commissioners on June 30th, asking that one might be erected and used for a fire-alarm bell, they replied on the 6th of July, stating that they did not consider the place eligible for that purpose; and, in their opinion, the erection of such a Tower would be detrimental to the plan of the structure; that it might become an attraction for visitors to the Reservoir, which for obvious reasons should never be a common resort.

The City Council having passed an Order authorizing the Commissioners to carry the water to East Boston, provided the expense should not exceed the sum of $400,000, the Commissioners sent them a communication, June 21st, in which they stated that they did not think it prudent or wise to commence the work until a further investigation had been made, and for that purpose, they had instructed the Chief Engineers, Messrs. Whitwell and Chesbrough, to make such further investigation as might be necessary to enable them to unite on a plan of construction and an estimate of cost, which would be submitted to the Council as soon as received. This was signed by Messrs. Hale and Curtis; and, July 24th, after the Report of Messrs. Whitwell and Chesbrough

had been made, as mentioned in Part I., Chapter X., Mr. Curtis, one of the Commissioners, made a Communication to the City Council in which he stated that the revised estimates amounted to $480,000, and that experience justified the belief that the sum proposed by the City Council is not large enough; and he therefore respectfully suggested that the above sum, or in round numbers $500,000, be placed at the disposal of the Water Commissioners for the purpose of supplying the inhabitants of East Boston with the Cochituate water; with such modifications of the proposed plan as the Water Commissioners shall deem best, and that the work be commenced forthwith.

On the 25th of July, Mr. Hale, one of the Commissioners, made a Communication upon the same subject, in which he says: "That the Commissioners have not agreed upon a plan which they deem unobjectionable, and therefore they are not able to form an estimate of cost which they consider entitled to reliance; and he himself is not prepared to recommend for adoption the plan proposed by the Chief Engineers, without important modifications which may materially increase its cost; but that he believes it to be the duty of the Commissioners to agree upon a plan, and report the cost of the same to the City Council, with as little delay as possible."

The Water Committee, not being satisfied with these Reports, sent a note to Mr. Baldwin, the other Commissioner, asking him to give his views on the subject. In his reply of August 6th, he reviews the whole subject at some length, and suggests that they consider the plan for obtaining the supply for East Boston from Spot Pond. In regard to the plan proposed by the Engineers, he says: "That there are difficulties and exposures to be encountered in pursuing the line of the bridges through Charlestown and Chelsea, no one will deny, but if the Cochituate water is to be furnished to the inhabitants of East Boston, I am not prepared to offer any other plan than that reported upon by the engineers, with perhaps some modifications as to the size of the pipes and the height of the Reservoir.

"As to the cost of the work, the Engineers have no doubt estimated its expense as high as they thought it necessary for its full completion, but that more than the amount of that estimate will not be expended in carrying through the enterprise, I am not willing to say."

He closes his Report, by saying: "If upon a careful survey, and the best estimate that can be obtained, the cost of introducing the water of Spot Pond into East Boston should be found not greatly to exceed the cost of conveying the Cochituate water there by the plan proposed, then I should prefer Spot Pond as the source; but if the water of Lake Cochituate is to be conveyed there, I would pursue the plan pointed out in the Engineer's Report."

On the 13th of August, the City Council decided to adopt the plan proposed by the Engineers, as mentioned in Part I., Chapter X.

At the same time, a vote was passed authorizing the Commissioners to lay a temporary pipe to East Boston. Accordingly, a two and one-half inch lead pipe was laid across the channel at the ferry landings, and extended on the East Boston side to Maverick Square, to a large Cistern built for the purpose. Water was let into this pipe for the first time, September 8th. A few weeks after it was laid, it was cut off by an anchor of a schooner passing over it; it was immediately repaired, and remained in operation until the latter part of December, when it froze up, and no effort was made to thaw it out, as the main line was nearly completed. The pipe was taken up during the Spring of 1851, when a portion was found frozen solid, and it was burst in several places. A piece of this pipe, about twelve inches long, is now in the possession of the Cochituate Water Board, at their office in the City Hall.

The East Boston Reservoir was finally located on Eagle Hill, and the first purchase of land for this location was made September 24th, 1849. The Estates purchased for this Reservoir were as follows:

| | | |
|---|---|---|
| J. Gooding's for | . . . . . | $2,250.00 |
| Sturtevant, Edwards & Co's. for | . . . . | 2,250.00 |
| Edward W. Brown's | " . . . . | 2,500.00 |
| Davis Hatch's | " . . . . | 2,250.00 |
| East Boston Company's | " . . . . | 14,612.50 |
| Total cost of land | . . . . . | $23,862.50 |

The offer of the East Boston Company to give an acre of land for the location of a Reservoir, which is referred to in one of the Reports of the Engineer, was made when the first survey was completed, and it was supposed the main pipe would cross Chelsea Creek, and upon the decision to locate the Reservoir at Eagle Hill where the land was more valuable, the offer was withdrawn.

Beacon Hill Reservoir having been completed, the water was let into it through the 30-inch pipe at half past nine o'clock, on the morning of November 23d, 1849, and it was filled in 18½ hours; in 21½ hours it had risen to 4½ inches on the wasteway by which the overflow is discharged into the common sewer; but, on account of numerous leaks, the water was drawn out for repairs.

The water was let into the SOUTH BOSTON RESERVOIR at four o'clock, on the afternoon of November 28th, 1849.

Several large claims for damages having been made, from persons living in the vicinity of the Newton tunnel, on the ground that they were deprived of water in their wells, in consequence of the construction of the tunnel, it was decided for the purpose of meeting these demands, and furnishing the parties with a sufficient supply of water, notwithstanding the Commissioners believed that the water would eventually return to the springs, to construct an Aqueduct in Newton, and a Company was formed according to the provisions of the Revised Statutes of the Commonwealth, under the name of the *Newton Aqueduct Company,* all the stock of which is now held in trust for the City.

This Company was organized at the Nonantum House in Newton, October 29th, 1849, at a meeting legally called for that purpose by George P. Sanger, Esq., Justice of Peace. At this meeting, David K. Hitchcock was chosen chairman, and George P. Sanger, clerk, and all the forms for the establishment of an incorporated Company were legally complied with. The capital stock was fixed at $10,000, divided into 100 shares of $100 each: Messrs. R. W. Holman, D. K. Hitchcock, and J. H. Silsby, were elected Directors. The assent of the Selectmen of the Town of Newton, was obtained for the construction of the Aqueduct, which consent was signed by Isaac Hogan, Stephen W. Trowbridge, Nathan Crafts, Benjamin W. Kingsbury, and Ephraim Grover.

At the date of its organization, ninety-six shares of the stock were held by R. W. Holman; and J. H. Silsby, Joseph White, David K. Hitchcock, and Orin T. Clark held one share each; subsequently, ninety-five of the shares of R. W. Holman, and the share of Joseph White were sold to the Company, and were afterwards held as follows: E. S. Chesbrough, City Engineer, and his successors in that office, Trustee for the City of Boston, ninety shares; R. W. Holman and assigns, Trustee for the City of Boston, five shares; Mr. White's and Mr. Hitchcock's shares were transferred to Messrs. Thomas Wetmore and E. S. Chesbrough.

A description of the property of the Company will be found in Part IV., Chapter XXIV.

The question having been submitted to the Commissioners as to the best mode of conducting the water works after their term of office expired, they replied, on the 18th of December, that they thought a Board consisting of a

Commissioner, Engineer and Registrar, who should be paid for their services, was better than a Board receiving no compensation.

Several applications for water for the supply of Fountains having been made, the Commissioners reported on the subject to the City Council, November 1st, in which they say: "The demand for this use being rather for embellishment, and the gratification of the taste, than for objects of necessity, it would be unreasonable to suffer it to interfere with the maintenance of an adequate supply of water for domestic, and other urgent purposes.

"So far, however, as a limited appropriation of surplus water can be afforded for this use, it seems desirable to favor this application of it, as a means of promoting health and enjoyment, as well as embellishing the public and private grounds of the City; and also as a mode of deriving some additional revenue. This can be done only by fixing moderate rates of charge, accompanied with suitable regulations and restrictions, by which the use shall be limited, whenever necessary, to a moderate quantity, which shall, in such cases, be proportioned to the compensation paid, in the same manner as where water is supplied for other uses. A profuse use of water for Fountains in the City, unless limited to the surplus not required for domestic and other indispensable purposes, would be a very costly luxury, especially if it be permitted to flow uninterruptedly."

They state that there are three classes of Fountains:

"First, such as are exclusively of a public character, as those on the Common and in the State House grounds. For the maintenance of Fountains of this class, the supply must be gratuitous, but the quantity appropriated to each should be subjected to fixed limitations, *not liable to be exceeded at the discretion of an individual manager;* and the periods of playing should be restricted by rules, subject to variation from time to time, according to the extent of the surplus water which may be thus appropriated without impairing the means of supply for more urgent uses.

"Second, Fountains erected in public squares appropriated to the embellishment of particular sections of the City, and for the more especial benefit of estates adjoining. Although Fountains of this description serve in some degree for the general embellishment of the City, as among its public ornaments, and for the common gratification of its citizens, they contribute more effectually to the gratification of those who reside in their immediate vicinity, and serve to increase the value of estates situated within view of them. It seems reasonable, therefore, that the citizens who enjoy this special benefit, and whose estates or places of residence are thus enhanced in value, should

contribute something, individually, to the cost of maintaining such Fountains. Otherwise, those citizens whose property and places of residence are so situated as not to afford them a participation in this special benefit might justly complain, that they were subject to a charge for the maintenance of a luxury in which they do not enjoy an equal share.

"The third class of Fountains consists of those which are strictly private, and are appropriated to the embellishment of private property.

"Ornamental Fountains of this class are justly deserving of encouragement, as contributing to the general embellishment of the City, and probably in some degree to the preservation of the public health; but they are luxuries of a strictly private nature, and the water for maintaining them should be paid for on the same principle, if not at as high a rate, as water for other uses. Yet as a rate of charge graduated on the scale by which the charge for more important uses is regulated, would in a great measure amount to a prohibition of its use for this purpose, it may be sound policy, so long as the supply of water in the City is superabundant for all other profitable uses, to encourage the appropriation of it to this use, at such rates as will be likely to insure the greatest income to the City, from the surplus which can be thus appropriated."

They then recommend certain regulations for the supply of water for Fountains of the several classes, and the rate of charge for each, and close their Report by saying: "there is reason to believe that for some years to come, there will be a large surplus, which may be safely appropriated in the manner here suggested."

In another communication to the City Council, December 24th, the Commissioners say: "The whole subject of supplying water for Fountains has been left undetermined by the Commissioners, because they did not feel authorized to consent to the use of the water for this purpose, for such rates of compensation as the parties applying therefor are willing to pay, without the consent of the City Council to a material abatement of the ordinary rates.

"In the absence of any regulations, several Fountains of a semi-public character have been supplied with water without compensation. Such an appropriation of water, gratuitously, is liable to become highly injurious to the public interest. It is now ascertained, from the quantity of water which is drawn from the Brookline Reservoir every night, that there must be a waste of water, which will have to be checked if possible, and a part of this waste is attributable to the use of it in Fountains."

The amount paid by the Commissioners to the principal Contractors were as follows:

| | | | | |
|---|---|---|---|---|
| Gonder, Case & Co. | $324,127.22 | on account of | | Beacon Hill Reservoir. |
| Edward Leonard & Sons, | 176,451.34 | " | " | Conduit and Tunnels. |
| Carmichael, Gonder & Co. | 165,979.90 | " | " | Conduit, Lake, Bridges, Culverts and Gate House. |
| Clarke, Christy & Co. | 65,978.35 | " | " | Conduit, Bridges and Culverts. |
| A. J. Hackley, | 64,372.54 | " | " | Brookline Reservoir. |
| William Gawne, | 62,195.86 | " | " | Conduit, Bridges, Culverts and Marlboro' Dam. |
| Ebenezer Johnson, | 37,176.79 | " | " | Gate-Houses, Bridges and Culverts. |
| James & Charles Collins, | 36,640.18 | " | " | South & East Boston Reservoirs, Bridges & Culverts. |
| C. H. Hill, | 28,674.42 | " | " | Excavations in the City. |
| Lead Pipe Co. | 27,302.20 | " | " | Lead Pipe. |
| Others for Bricks, | 197,928.47 | " | " | Conduit. |
| " " Iron Pipes, | 1,137,512.82 | " | " | Distribution in the City. |

The total of the payments by the Commissioners, less credits for materials sold, was $3,998,051.83.

The Commissioners in their final Report, January 4th, 1850, say: "We feel bound to express our acknowledgments to the Chief Engineers, William S. Whitwell and E. S. Chesbrough, Esquires, for their very able services, for their most faithful and satisfactory discharge of all the duties devolved upon them, and their constant devotion to the expeditious and thorough execution of the work in their respective departments.

"To their skill and efficiency, we are greatly indebted for the successful completion of this great work." They also express their acknowledgments to the various officers of the City Government, and to the several persons employed upon the works and in the office of the Commissioners.

# PART THIRD.

PROCEEDINGS OF THE COCHITUATE WATER BOARD,

FROM ITS ORGANIZATION, IN 1850,

TO

JANUARY 1ST, 1868.

# CHAPTER XV.

## 1850.

Members of the Board — Management of the Works — Their first Meeting — Contracts for the Piles and Lumber for the Bridge at East Boston awarded — Appointments made — Syphons, and the Appointment of a Superintendent to lay the same — Gratuitous supply of Water — New Rooms for the Board — Contracts for the Construction of the Bridges — Insurance of Buildings by the City — Height of Water in Dug Pond — Contracts for Dredging and Excavations — First Syphon laid — Drinking Hydrants — Boats on the Lake — Playing of the Fountains — Use of the Grove near the Lake — Pipe across Chelsea Creek — Damages to the Brackett Place on account of the loss of Water, and the agreements in relation to the same — Supply of Water for the Navy Yard — Lantern on the Beacon Hill Reservoir — Application for Water to run an Hydraulic Engine — Water Tariff — Annual Report of the Water Board — Foundations of the Conduit — Waste of Water at the Lake — Communication from the Water Board of 1850 to the Board of 1851 — Taxes — Regulations of Heights, and Discharges of Water — Fountains — Waste of Water — Lands — Use of Water as a motive Power — Provision for an increase of supply of Water for Shipping — Ordinance — Application for the free Use of Water by the Children's Friend Society — City Solicitor's opinion on the same.

THE election, by the City Council, of E. S. Chesbrough, W. S. Whitwell, and J. Avery Richards, to constitute the FIRST COCHITUATE WATER BOARD, took place January 4th, 1850, as mentioned in Part I., Chapter X.

They had the control and management of the water works in connection with and subject to the approval of the Joint Standing Committee on Water, to whom they made weekly Reports. Their first meeting was held at the office of the late Commissioners, January 5th, 1850.

At their second meeting, on the 9th, the proposals for the piles and lumber for the bridge work on the East Boston Extension were opened and the contract awarded to Messrs. Roby and McEuesten.

During the month of January, the following appointments were made by the Board, and approved by the Committee on Water:

COMMISSIONERS' DEPARTMENT.

MARSHALL CONANT, *Surveyor.*
JOHN VANNEVAR,
*Inspector of Lake Cochituate.*
STEPHEN GODING, *Inspector of 2d Division.*
ALBERT WOOD,
*Inspector of Hopkinton Reservoir*
E. F. KNOWLTON, *Inspector of Brookline Reservoir and Aqueduct repairs.*
JOHN H. MAYNARD,
*Inspector of Marlboro' Reservoir.*

ENGINEER'S DEPARTMENT.

GEORGE H. BAILEY, *Principal Assistant.*
CHARLES PERKINS, } *Draftsmen.*
FREDERIC BALDWIN, }
S. N. DYER, *Clerk.*
ALBERT STANWOOD, *Foreman on Repairs.*
JAMES SLADE, *Assistant Engineer.*
GREELY S. CURTIS, } *Rodmen.*
N. H. CRAFTS, }
J. WADLEIGH,
*Foreman on Wharf and Reservoir.*
MR. KNAPP, *Plumber.*

REGISTRAR'S DEPARTMENT.

CAPT. ALDEN GIFFORD,
*Superintendent of Shipping.*
WILLIAM F. DAVIS, *Clerk.*

COMPTROLLER'S OFFICE.

CHARLES H. LITTLE, *Clerk.*
WILLIAM S. MCGOWAN, *Clerk.*

On the 22d, the Water Committee having asked for a statement from the Board, of the contracts made for the East Boston Extension, they replied: That they had made contracts with the South Boston Iron Company, for 2,500 tons of iron at $42 per ton; and with Coleman and Kilton, of Philadelphia, for 400 tons, at $41, and that the amount of contracts thus far made was as follows:

| | | |
|---|---|---|
| Iron Pipes as above, | $123,500. | |
| Construction of the Reservoir, | 35,000, | with James and Charles Collins. |
| Piles and Lumber, | 17,511, | " Eastman, Roby and McEuesten. |
| Lumber for Syphons, | 500, | " Wm. Pope & Sons. |
| Total, | $176,511 | |

It having been voted by the Committee on Water, on the 22d January, that the three syphons should be constructed and put down by workmen paid by the day for their services, on the 28th Mr. Charles Emerson was appointed by the Water Board, Superintendent of the construction and the placing of the syphons.

Simeon Borden was appointed by the State, a Commissioner to inspect the construction of the Water Works across the several bridges, as provided for in the Act.

Several petitions having been received by the City Council in favor of supplying the "Colony" belonging to the ship "California Packet" with water free of cost, they were referred to the Water Board, who made their Report, February 19th, in which they say: "that it would be inexpedient to grant the request. Without doubting that in the present instance there are good reasons why the petition should be granted, the Board believe that such a precedent would afford encouragement to many others to ask similar favors which not only would become very troublesome, but would diminish the revenue of the city.

"Such objections may seem rather fanciful than real; but a very slight practical acquaintance with the collection of water rents will satisfy any one that there is a much wider-spread disposition than could at first be supposed, to get rid of paying the reasonable and low rates now charged."

February 25th, it was decided to fit up rooms for the Water Department in the City Building in Court Square, at the corner of Williams' Court, and on Saturday, March 30th, they removed to the new rooms.

March 12th, contracts were made with the following parties for the construction of Charles and Mystic River Bridges for the Aqueduct.

Gould & Shackford, of East Boston.
Bixby & Cole, " "
Mayor & Wentworth, " "
Moses Austin, of Salem.

The pile work on Mystic River Bridge was commenced April 18th.

The Committee on Water were instructed by the City Council to consider the expediency of the City's taking Insurance Risks, and the propriety of supplying those buildings insured by the City with water at lower rates. After several months' consideration the Committee reported the reference of the matter to the next City Government.

The first WATER METERS, for estimating the quantity of water used, were purchased April 25th, 1850; they were known as the Hughes' Meters, but as they did not meet the expectation of the Board, their use was discontinued.

On April 27th, Mr. Moses Fiske of Natick made complaint to the Board that the water of Dug Pond had been raised four feet higher than the City had a right to raise it; whereupon notice was sent to Mr. Richardson, requesting him to explain to the Board what rights the City obtained from Mr. Knight, which he did on the 29th, stating that he did not believe that Dug Pond was higher than the *old water line*, although several feet higher than it had been for a great many years. In the course of his remarks, he stated that the Indians are said to have been the first to drain down this Pond;

about thirty years ago the Framingham Manufacturing Company drew it down, and in order to fill it up again in the course of a season, bought the following rights of different persons to enable them to turn Bacon's Brook into it, viz:

GEORGE WHITING,
——— BACON, } *for ten years.*
——— HAVEN,
and MOSES FISKE, *permanently.*

Afterwards, Mr. Knight purchased the Haven right permanently, and the Bacon right for eight months in each year, beginning the first of October, and ending the first of June. The City now possess all the rights that Mr. Knight did; and, in consequence of various transfers and changes, possess nearly the whole of the Whiting right, — at least it has been so nearly extinguished, that what the City does not possess will not be likely to cause any trouble. During the month of May, the perpetual right of Mr. Bacon was purchased by the City for $200.

A contract was made with Mr. Charles Wooley to dredge a trench for three syphons at the Draws of the Warren and Chelsea Bridges for two thousand dollars; and to dredge for the Pipe across Chelsea Creek, for three thousand dollars. A contract was also made with Daniel Crowley for dredging the general trenches for the pipes, and replacing the earth after the pipes were laid, at the following prices: 22 cents per cubic yard excavation, and bulk-fitting for the 20-inch pipe; and at 18 cents for the 16, 12, and 6 inch pipe; the total contract amounted to about four thousand dollars. On Thursday, June 13th, the first syphon was put in place at Warren Bridge, the navigation being interrupted but twenty-eight and one-half hours; the depth and span of the syphon will be found in Part IV., Chapter III.

Several Petitions having been sent to the City Council for the establishment of *Drinking Hydrants* in the Public Streets, they were referred to the Water Board, who decided, July 5th, that it was inexpedient, for the following reasons:

"1st. They are liable to get out of order, and thus prove a source of frequent expense.

"2d. They often prove a nuisance to passers by, in consequence of boys collecting around them, and throwing water about; and in consequence of the mud and dirt, which it is almost impossible to prevent from collecting about them.

"3d. They necessarily cause a great waste of water.

"4th. They are, in many situations, injurious to the revenue, by furnishing

water free of expense to persons residing or doing business in the vicinity, who would, otherwise, be willing to pay for it.

"5th. They are dangerous, in consequence of the accumulation of ice around them in the winter season."

Before coming to their decision, however, they wrote to the Superintendents of the Water Works in New York and Philadelphia, asking for their experience, both of whom replied that they had discontinued the erection of them, and were removing the old ones as fast as they got out of order; that they were a public nuisance, rather than a benefit, and were also a great source of waste.

Mr. Vannevar, the Superintendent of the Lake, having reported that he was much annoyed by persons putting boats on the lake, and letting them to various parties; Mr. Richardson was notified that the Board were anxious to get rid of the boats, and requested him to have the evil remedied in the most peaceable way that he could.

On the 13th of July, the Mayor requested that the Fountains in the Squares on the Neck should be allowed to play all day, and that the Superintendent of Lands be notified to that effect; the Board, however, voted it was inexpedient to let them play more than four hours a day, as they do at present, and that the control of them ought not to pass out of the hands of the Board, as they are the best judges of how much water can be spared, and when.

In the Report of the Board to the Water Committee, July 16th, they say: "Agents of several religious and other Societies of this City have asked permission to use a grove belonging to the City, near the Lake, for picnic parties; two or three such parties have already been allowed to go there, and others are applying daily. The Board see no objection to granting such permission, and shall continue to do it, unless otherwise directed by the Committee."

The free use of this grove was granted for several years, but was finally discontinued on account of the injury to the premises, which resulted from such use.

On the 23d of July, after considerable discussion, it was decided to cross Chelsea Creek by means of several jointed pipes. At the point of crossing, on the Chelsea side, a water lot of one hundred feet frontage, was purchased of Mr. Ober, for the sum of $3,000; and on the East Boston side, one of fifty feet front was purchased of the East Boston Company, for the sum of $1,750. The pipes were completed and lowered into the trench on Thursday, November 14th.

On the 30th of July, the Brackett claim for the loss of water, occasioned by

the construction of the Newton tunnel, came before the Commissioners to whom the question of damages was referred. The question being asked the Water Board, if the City would guarantee a constant supply of water to the Brackett Place through the Newton Aqueduct, they requested time to consider before giving their reply, which was granted; and on the 24th of August, they decided that the City would only agree to keep the Aqueduct in repair, but would not guarantee a supply of water. According to the above decision, a special guarantee was made, and accepted on the 20th of December, by the City to Ann, Clarissa and Hannah Brackett, that the agreement between the Newton Aqueduct Company, and the said Bracketts and others should be faithfully kept and performed.

During the month of August, application was made by the United States authorities for the use of the Cochituate water in the Navy Yard. This application was referred to the Board, who reported that the request be granted, on the condition that the expense of the pipes from the main into and through the yard be paid by the United States, and that in the event of a scarcity of water, the City have the right to shut off the supply.

These conditions being agreed to on the part of the U. S. authorities, the pipes were laid and the water was let on. The Navy Yard was furnished with the Cochituate Water until the year 1865, when the Mystic Water Board connected their pipes with those in the yard, and the Cochituate pipe was disconnected.

On the 27th of August, it was voted to put an Iron Lantern, with a Tablet, over the staircase leading to the top of the Beacon Hill Reservoir.

At the same date, there was an application from the proprietors of the Boston Evening Traveller for the use of the water for running an hydraulic engine, with an offer to pay for the same the sum of one cent per hundred gallons. After considerable discussion, it was voted to accept the offer for one year. The use of the water for this purpose was continued until December, 1855, when the use of this engine was given up.

During the year, the Water Tariff caused considerable discussion in both branches of the City Council, and was finally referred to a Committee of Conference, who reported a tariff, which was adopted on the 18th of November, 1850.

The Annual Report of the Board was made to the City Council, December 10th, in which they gave a full account of their receipts and expenditures.

In speaking of the Conduit they say: "Several portions of the Aqueduct were built on puddled embankment. Though a very economical mode of

construction, it was looked upon as somewhat of an experiment; but the result shows that where these embankments were made of sand and gravel, the Aqueduct has already come to a firm bearing, and has given very little trouble with regard to repairs; where the Aqueduct was built upon puddled clay, the result has not been so satisfactory; but even in the latter cases, it has not been necessary to make any repairs, during the year, except in one place, and for that the amount expended was very small."

They estimate the waste of water at the Lake as a little over an average of 15,000,000 wine gallons per day, and that the Lake might have supplied an average of 20,000,000 gallons per day during the past season, could it all have been saved.

January 6th, 1851, after their term of office had expired, the Commissioners sent a Communication to the New Board, giving a full statement of the condition of the Works. It was classified under the following heads.

UNFINISHED WORK, which referred to the extension of the works to East Boston.

OFFICERS EMPLOYED, giving the name, position and salary of each.

TAXES, stating that they were unjust, and that they had been paid under protest, with the exception of the Wayland tax bill, which had not been paid, "because it has been thought best not only to deny the right, but to resist at once the enforcement of any claim for taxes upon structures belonging to the City, and necessary for the proper use of the Water Works."

REGULATION OF HEIGHTS, AND DISCHARGES OF WATER, on which they say: "As the Water Act allows the City to flow the Lake to a height of but eight feet (subsequently, by an addititional Act, raised to ten feet) above Knight's Flume, it is necessary to keep its surface, in most seasons of the year, from one to two feet below this level, in order to provide against freshets, which coming suddenly, sometimes raise the height of the Lake two feet in one or two days, notwithstanding all the means of keeping it down may be used to their utmost extent. If the City owned the fee of the margin entirely around the Lake, it would not be necessary to be so careful about this.

"Efforts have been made to obtain the fee, in every settlement; and with only three exceptions, in the case of private individuals, it has been secured entirely around the Lake; in these three, it may be obtained, but at enormous rates."

They say, of Fountains, "it is very evident, that the time is fast coming,

when all these must be played much more sparingly; and for this reason permission to establish new Fountains should be withheld."

They notice the extravagant WASTE OF WATER IN THE CITY, and remark that every means should be used to prevent it.

No PUBLIC HYDRANTS, with the exception of those on the Common, had yet been established.

They state that "a great many tracts of LAND have been purchased, and damages to other tracts paid for by the City, on account of the Water Works. Plans and descriptions of these lands, as well as the conditions on which they are held, should be so arranged and kept, as to be easy of access, and readily referred to. As the settlements are not all completed, it has been impossible to finish such an arrangement; but a great deal has been done towards it." They give a list of the unsettled claims.

USE OF WATER, AS A MOTIVE POWER, they speak of in connection with the application of the Evening Traveller, before referred to, saying: "That it would not be advisable to encourage an increase of this kind of Motive Power, under existing circumstances."

They recommend the more thorough draining of the meadows, through which the streams pass that flow into the Lake. After stating that it was by no means impossible, or even improbable, that the time would arrive, when more water would be required, they mention the following as the SOURCES from which such an ADDITIONAL SUPPLY could be obtained; First, "The most natural and easy one would be to turn Sudbury River into the Lake; but this would involve the City in vexatious lawsuits with the mill owners below, and with the Middlesex Canal Company. The Second would be to raise the Lake several feet higher, (which has since been done,) and thus increase its capacity as a Reservoir. Third, to purchase the outlet to Nonesuch Pond, in Weston; and the immediate valley of the stream between the outlet and the Aqueduct."

They then give general information, under the following heads: STONE RESERVOIR, PIPES, PERSONAL PROPERTY and REPAIRS.

One of the most important subjects that occupied the attention of the City Council, Water Committee and Water Board, was the best method of supplying the shipping with water.

The Commissioners, believing it to be for the best interest of the City to have the entire control and management of this source of income, appointed Capt. Alden Gifford, Superintendent of Shipping for one year; whose duty it was to take the entire charge of this department; but the City

Council thought it was best to let it out by contract, and directed the Water Registrar to advertise for proposals for supplying the shipping for two years; in answer to which, only two bids were received, both of which were for less than half the sum the Water Board considered it worth, and a communication to that effect was sent to the City Council. February 26th, Mr. T. B. Curtis, one of the late Commissioners, sent a letter to the Water Board, in which, after stating the number of vessels that clear from this Port in the course of a year, the average number of gallons of water required by each, and the price formerly paid by vessels for water, 62½ to 75 cents per hhd., he says: "During the past year, I gave this branch as much attention as my engagements officially permitted, and the result was a conviction, that with judicious management, and a firm administration of the supply, an income of at least $10,000 might be secured in aid of the water fund, while the Merchant and Ship Owner should be charged only one-third of the rates which were demanded a year ago. It is well known that since 1845, the period alluded to in my calculation, there is a large increase in the size of ships, and that many more are now employed as 'passenger vessels' than formerly.

"My estimates, in round numbers, are for foreign and domestic clearances, 7,000 vessels, the number in 1845, taking ten casks each at 25 cents per cask, equal to $17,000.

| | | | |
|---|---|---|---|
| Expenses. — | Overseer, say | $1,500. | Income. — $17,000. |
| | Six men, at $1.25 per day, | 2,250. | |
| | Two boats and four men, | 1,600. | |
| | | | 5,350. |
| | Net, | | $11,650. |

"Apart from the pecuniary advantage to enure to the City from keeping this business within its own control, will be that of knowing *what the supply is worth*, and the satisfaction of knowing to whom to look for reparation, should waste or injury to the Hydrants occur. The nature of the apparatus demands that a vigorous supervision should be exercised over all who are permitted to approach or handle it; for if the Hydrants are carelessly left to run, as is the case in some places, the 'third pipe' for the supply of the City, will be required some time sooner than has yet been anticipated."

The City Council decided to accept the offer of H. H. W. Stimson and others, and directed the Water Board to make a contract with them for supplying the shipping for two years from the fifteenth day of May; and to notify Capt. Gifford that his services would not be required after that date. Capt. Gifford, however, took another view of the question, and sent a letter to the

Board, on April 15th, in which he refused to give up his office, on the ground that he had been employed by the Commissioners for one year, from January 2d, 1850.

The parties to whom the contract was awarded, commenced to supply the shipping by order of the Board, and Capt. Gifford sent to the Board, that according to his instructions, he gave them notice that the said parties were opening the Hydrants and supplying vessels in opposition, and to the damage of the City; whereupon, the Board ordered him (Capt. Gifford) to discontinue at once the supply of vessels with water. No notice, however, was taken of the order, and both parties continued to supply until about the middle of June, when the Captain gave up, but put in a claim for his salary for the whole year, which he afterwards obtained in full.

The contract referred to was made with H. H. W. Stimson, Charles Smith, Gustavus Peterson, Elijah Gould, Charles Watson, Paul Knowles, J. E. Jameson, and Frederica Butler, the last two named being widows. It provided that they should have the exclusive use of the Cochituate Water for the term of two years, from May 15th, 1850, for the supply of the shipping for the district of Boston and Charlestown, exclusive of steamboats, the said parties paying to the City the sum of two thousand and twelve dollars per year, in equal monthly payments.

They were to take the water from such Hydrants as were agreed upon by the Water Board, and to charge for the same a sum not exceeding twenty-five cents per hogshead; but when the water boats had to be used, they could charge a sum not exceeding thirty-seven and one-half cents per hogshead; they were to keep books, containing a record of all sales made, which were to be open at all times to the inspection of the Board. It was also provided, that if they used the water for any other purposes, or neglected to perform or keep either of the agreements mentioned, the City reserved the right to vacate and end its agreement by giving thirty days' notice, in writing, signed by the Mayor.

The Ordinance providing for the care and management of the Boston Water Works, from Jan. 1st, 1851, was passed October 31st, 1850.

Section 1, provides that there shall be chosen annually by the City Council, one Alderman, one Member of the Common Council, and five Citizens at large to constitute the COCHITUATE WATER BOARD, who shall hold their offices until they are removed; no person shall be chosen for more than five consecutive years.

Section 2, provides that these persons shall organize themselves by the

choice of a President, and a Clerk; with such rules as they may deem expedient for their government, and for that of subordinate officers.

Section 3, provides that the Cochituate Water Board shall exercise all power granted by the Act for supplying the City of Boston with pure Water, passed March 30th, 1846; and shall have power to appoint all necessary subordinate assistants.

Section 4, provides that the Cochituate Water Board shall, by the fifteenth day of January annually, present to the City Council a full Report of all their proceedings connected with the Water Works; and at the same time there shall be presented the Reports of the City Engineer, and Water Registrar respectively.

Section 5, provides that the Cochituate Water Board shall, whenever requested by the City Council, furnish a Schedule of Water Rates.

Section 6, provides that the Water Board shall have power to sell or lease the property connected with the Water Works, subject to the approval of the Mayor and Aldermen.

Section 7, provides that all bills shall be drawn for by the President, examined by the Auditor, and approved by the Committee of Accounts, before being paid by the Treasurer.

Section 8, provides that the President of the Cochituate Water Board shall exercise a general supervision over all affairs connected with the Water Works; in case of his absence, his duties may be performed by a President *pro tempore.*

Section 9, provides that there shall be chosen annually in September or October, and whenever a vacancy occurs, a City Engineer.

Section 10, provides that the City Engineer shall take such charge of Lake Cochituate, its lands, Aqueducts, Reservoirs and other property, as the Water Board or City Council shall direct.

Sections 11, 12 and 13, also provide for the duties of the City Engineer.

Sections 14, 15 and 16, provide for the choice of a Water Registrar, and his duties.

Section 17, provides that the Water Rents shall be payable in advance on the first day of January, annually.

Section 18, provides that in case of non-payment of Water Rent, the supply of water shall be cut off.

Sections 19 and 20, provide for further power and duties of the Water Registrar.

Section 21, provides that no member of the Water Board shall be interested in any contract in connection with the Water Works.

Sections 22, 23, 24 and 25, provide for penalties, in case of opening Hydrants, Pipes, or Reservoirs, turning off the water, or injuring any public Reservoir.

Section 26, provides that the water shall not be sold to parties out of the City.

Section 27, provides for the Regulations under which the water shall be taken.

Section 28, provides that this Ordinance shall take effect on and after January 1st, 1851.

In the early part of the year, the City Council received a Petition from the Children's Friend Society, asking for the use of water without charge, which was referred to the City Solicitor, for his written opinion, as to the power of the City to grant the request. In his reply, City Document No. 13, 1850, he says: "The City Council are the agents and trustees of the Inhabitants of Boston, with a limited authority; they can perform no act in the execution of their trust unless warranted by some general or special law of the Commonwealth, either by express terms, or by reasonable inference. These general principles are decisive on the question now proposed.

"If in the general view of the subject, the water is to be regarded as valuable property, the City Council have no more right to give it away, than they have the right to make a donation of the City lands, or of the money in the City Treasury. . . . . If the City Council may give the water to one institution of this kind, they may to all. If they may give it to a charitable institution, they may to an individual. If they may give it to a poor corporation, they may to a poor man. If they may give it to an institution which is doing great good in the community and on this account, they may give it to a good man. In short, the same reasoning would authorize the City Council to vote the water free at once, and thus take from the scrip holders the fund which is expressly set aside and pledged by law for their security." (City Documents on subject of water for year 1850, Nos. 3½, 7, 13, 29, 32, 32½, 41, 45, 51.)

# CHAPTER XVI.

## 1851.

Water let into East Boston Reservoir — First Cochituate Water Board under its present organization — Rooms for the Board — Purchase of the Jamaica Pond Aqueduct, and the difficulties attending the same — Reorganization of the Fire Department — Waste of Water — Election of Superintendent — Use of the arches under the Beacon Hill Reservoir — Use of the Water granted to the McLean Asylum and State Prison — Election of Service Clerk — Vote passed to close the Construction Account — Pipe for supplying the Fountain in Lowell Square — Water Meters for Brookline Reservoir — Fountains allowed to play for certain hours — Subject of carrying the Water to Deer Island — Election of the Members of the Board — Free use of Water for Fountains — Complaints of a bad taste to the Water — Refunding money once paid — Large stop-cock out of order — Leak in East Boston Reservoir — Hyde Place ordered sold — Temporary Lead Pipe taken up — Appropriation to meet excess of interest over receipts — Annual Report — Supply of the High Service.

WATER was let into the East Boston Reservoir, for the first time, on the morning of January 1st, 1851, in the presence of the City Council, and invited guests, who afterwards, on invitation of the East Boston Company, partook of a collation at the Maverick House.

The FIRST COCHITUATE WATER BOARD elected UNDER ITS PRESENT ORGANIZATION, and according to the Ordinance in the preceding Chapter, were:

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| Messrs. Henry B. Rogers, | Messrs. Thomas Wetmore, |
| " James W. Sever, | " John H. Wilkins, |
| " Jonathan Preston, | " Samuel A. Eliot, |
| | John T. Heard, |

Their first meeting for organization was held on January 2d; at which meeting, Thomas Wetmore was chosen President, and Samuel Holbrook, Clerk. At the same time, a Committee, consisting of Messrs. Wilkins and Sever, were chosen to consider and Report what Officers it would be necessary to appoint,

and what should be their compensation, and also such code of Rules and By-laws as they may deem proper to facilitate the proceedings of the Board.

On the 27th, a Memorial was received from the Jamaica Pond Aqueduct Company, asking for a hearing in regard to the sale of their property to the City, and also in relation to the damages; which hearing was granted on March 26th. Charles Amory, Esq., appeared in behalf of the Corporation, at the meeting of the Board on April 2d, when it was voted to offer to the Corporation the sum of $45,000 for their property, including all claims for damages. This offer was accepted by the Corporation on April 30th, but before the papers were prepared, the City Council passed the following vote: "Ordered, that the Joint Standing Committee on Water be directed to consider, and report as soon as practicable, whether the Water Board, as at present constituted, has the authority to purchase the property and franchise of the Jamaica Pond Aqueduct Company, and whether such purchase by that Board would be legally binding on the City; and that said Committee have leave to consult the City Solicitor concerning the same. Also to consider, and report whether it is expedient for the City to purchase the property and franchise, or either of them, of said Aqueduct Company."

After this vote was passed, and before the Committee made their report, the President of the Board sent a letter to the Chairman of the Committee, in which he says: "The attention of the Water Board has been called to the action of the City Council on the subject of the agreement made by the Board for the purchase of the franchise and properties of the 'Aqueduct Corporation.' It was the intention of the Board to report hereafter to the Council, all the facts relating to the purchase, and their reasons for making it, when it should be finally completed. The action of the City Council, however, as it seems not only to question the expediency of making such a purchase, but also to deny the right and power of the Water Board to do it, makes it necessary for the Board to anticipate the time intended for giving the City Council the requisite information on the subject; and the Board have now directed me to make a statement of the facts relating to the purchase of the Aqueduct property, to the Chairman of the Committee of the Council on Water.

"With regard to the powers of the Water Board, it never occurred to them that any doubt on the subject could be entertained. By the sixteenth section of the Water Act, the power is expressly given to the City, and by the fifth section, it is provided that all the powers given to the City by the Act shall be exercised by such agents as the City Council shall appoint; and the City Council, accordingly, by the Ordinance establishing the Water Board, having expressly vested all the powers which it derived from the Act, which could be

legally delegated, in the Cochituate Water Board, it seems most manifest that the Board are the agents appointed by the City, with all the powers which the City has over the subject."

He then states that an offer for a much larger amount had been recommended by the Water Commissioners, which had passed one branch of the City Council: he also gives in detail the many advantages to be obtained by the purchase, and says that on account of these advantages they determined to offer to the Aqueduct Company, *forty-five thousand dollars*, for the conveyance of their franchise and all their properties, except a lot of land in the first named City, in Boston and Roxbury, and a release of the City from all claim for damages. The offer has been accepted, and the Board were prepared to draw on the City Treasury for the amount of money required, so soon as the proper conveyance could be prepared by the City Solicitor. The action of the City Council will, however, prevent their doing this, and the final transfer must be postponed. In the mean time, he would suggest that if the Board have the power to purchase this property, the Aqueduct Corporation will have a fair claim for interest on the amount agreed to be paid.

He states, in conclusion, that the Water Board have merely had regard to what they believed the real interests of the City in this transaction; that they have not doubted their power, nor have imagined that the result of their action would not meet the hearty concurrence of the City Council.

Soon after the receipt of this communication, the Committee made their report, as follows: "that on examination of the Ordinance of October 31st, 1850, establishing the Cochituate Water Board, and the Act of the Legislature, authorizing the City of Boston to bring the Waters of Long Pond into the City, they are unanimously of the opinion that the Cochituate Water Board had the power to purchase for the City all the property, estates and privileges of the Aqueduct Corporation. It will be seen from the communication of the President of the Water Board, that such purchase had been made prior to the introduction of the Order by which the subject was referred to this Committee, and, therefore, the Committee do not deem it necessary to enter into the expediency of this act on the part of the Water Board, as the City Council have made the Board the agents of the City for this among other purposes, and the purchase having been made, it is, in the opinion of the Committee, legally binding upon the City.

"Nor do the Committee doubt that the Board honestly adopted a course which they consider for the best interests of the City. They, however, think this a proper occasion to remark, that, in their judgment it is desirable to consult the City Council in all large operations of this description; and the

Ordinance giving them the power under which they act seems to contemplate this, in the provision that a member of each branch of the City Council shall be a member of the Water Board, and also by the third section of the Ordinance before referred to, which provides that all the powers given to the Water Board shall be subject to the regulations, orders and ordinances of the City Council; and the Committee firmly believe that such was the expectation of the City Council when the Ordinance was created, under which the Water Board have acted in making the purchase to which the order of the 12th of May referred."

On June 12th, the Board sent another Communication to the City Council, from which we make the following extract: "The Cochituate Water Board beg leave to report to the City Council that they have completed the purchase of the property of the Aqueduct Corporation, by accepting, on behalf of the City, conveyances of the same, prepared under the direction of the City Solicitor; and the President has given a draft on the City Treasurer for the consideration stipulated to be paid, amounting, with the interest, to forty-five thousand two hundred and seventeen dollars and fifty cents ($45,217.50). The business has been thus closed before the final action of the City Council, on the subject of the powers of the Board, at the suggestion of the Mayor, to relieve the City from any further payment of interest.

The conveyances which the Water Board now submit to the Council consist of—

A deed of all the property, estate, rights and privileges of the Corporation, and all debts due to it since April 30th, last, and a release to the City of all claims.

A bond, in the penal sum of ten thousand dollars, to save the City against all claims to the 30th of April, 1850; an agreement signed by Thomas A. Dexter, and Edward A. Dexter, to whom all the shares of the Corporation have been assigned as Trustees of the City, without compensation to transfer the shares on demand of the Mayor or President of the Water Board, at any time within three years.

In the same communication, they ask that an ordinance may be passed for the management of the works; whereupon an additional Ordinance was passed putting the works under the management of the Cochituate Water Board.

On account of the introduction of the Water, it became necessary to reorganize the Fire Department of the City; and a Joint Special Committee

of the City Council was chosen to consider and report; the persons chosen on this Committee were, Messrs. Henry B. Rogers, Henry M. Holbrook, Benjamin Smith, Daniel N. Haskell, Albert T. Minot, James W. Sever, Richard Shackford and Charles H. Stearns, two being members of the Water Board.

Their Report, which was made to the City Council, covering with the Ordinance 28 pages, was a very interesting one, and contained a great deal of information. See City Document No. 32, for the year 1851.

In February, the waste of water had increased to such an extent, the President was authorized to prepare a communication to the citizens on the subject, and have the same printed and distributed.

During the same month, J. Wadleigh was elected Superintendent of City Reservoirs and Fountains, and Albert Stanwood, Superintendent of the Iron Pipes and Pipe Yard. Leave was also granted for the City to use the arches under the Beacon Hill Reservoir, for an Engine and Hydrant Company, on the condition that the City would pay rent for the same.

During the month of March, a petition from the McLean Asylum for the Insane, in Somerville, and also one from the Inspectors of the Massachusetts State Prison in Charlestown, were received, asking that they might be supplied with the water. This was granted, April 23d, with a special agreement that it could be discontinued at any time. The connection, however, with the City pipes was not made until the following November. They continued to draw their supply from this source until the year 1865, when the pipe was disconnected. March 19th, Mr. Samuel N. Dyer was elected Service Clerk; and March 26th, the Board voted that the construction account should be closed the 30th of April, 1852.

On April 2d, application having been made to have the pipe laid for a Fountain in Lowell Square, it was voted: "That the President have power, at his discretion, to lay pipes from the main to the Fountain, at the expense of the City, upon the condition, however, that this Board does not hereby agree to furnish water for said Fountain, free of expense.

The City Engineer, in his Report to the Board on the 23d of April, recommended that two of Huse's Water Meters be purchased, at an estimated expense of $1,000 each, and placed in the Brookline Reservoir, to measure the water delivered into the main pipes. This recommendation was adopted in the following month, and the Meters were purchased, but they proved a failure, and were ordered to be removed May 22d, 1856.

The Mayor having requested that the Fountains at the South End might play every day, as it would facilitate the sale of land, it was voted on the 20th

of May, that they be allowed to play one hour and a half before sunset every afternoon. On the 28th, they were ordered to be played one hour in the A. M. and one hour in the P. M.; on Sundays, from four P. M. to sunset, and on public days as directed by the President.

June 7th, at the request of the Common Council, the Fountains in Blackstone and Franklin Squares were ordered to play four hours on every pleasant day. This order was rescinded August 20th.

In the month of May, the City Council passed the following Vote: "*Ordered,* that the Cochituate Water Board take into consideration the subject of supplying the new Almshouse at Deer Island with Cochituate water, and report the result of their investigations to the City Council."

On May 22d, they made their Report, in which they say: "It is presumed that the principal objects which the Council had in view, in referring the subject to the Water Board, were to ascertain the cost of conveying the water to Deer Island as proposed; the power of the City, with its present means, to afford a supply for that purpose; and the necessities which the institutions now labor under for want of the same. In order, therefore, to ascertain the cost of laying the mains for supplying water to the Island, and also the wants of the Institution, the Board has directed the City Engineer to make a survey and measurement of the distance, and an estimate of the cost; and to report such facts as he could obtain in relation to the present means of supply on the Island, and their future increase." . . . . . "It appears from the Report of the Engineer, that the length of pipes to be laid from the present termination of the 6-inch pipe in East Boston, across the channel, to the hill north of the Almshouse, is 26,050 feet; that the cost of laying a 6-inch pipe the whole distance, including flexible joints for crossing the channel, boxing across the bridge at North Chelsea, and a Reservoir at the Island, will be, . . . . . $28,050

Cost of the same, deducting about 18,000 feet, which might be laid of wood, say, . . . . . $19,050

Cost of Iron and Wooden pipe as above, deducting at least $1,500 by using Gutta Percha pipes across the channel at Deer Island, 17,550

The above calculations are for a wooden pipe four inches in diameter, and an iron pipe of six inches.

By reducing the iron pipe to four inches and the wooden to two inches, and using the gutta percha for crossing, the cost would be reduced to $13,750

The Iron and Wooden pipes of the larger size will deliver sixty feet above tide level, 56,537 gallons a day, and at forty feet, 69,250.

The smaller sized pipes will deliver 12,424 gallons a day, at forty feet above tide.

"With regard to the use of Wooden pipes, there seems to be ample evidence of their durability to justify it, when they can be placed across marshes and similar places, in which they can be kept constantly wet; in fact they may be considered in these places as almost indestructible, and the only wear which they would suffer is a slight one from the friction of the water in the interior. It has been stated by persons having the care of the Aqueduct from Jamaica Pond, that the pipes which had been buried for upwards of forty years in wet land were found, when taken up, to be almost as sound as when they were first laid down.

"In the foregoing estimate, nothing is said about land damages, and if the Iron pipe is laid the whole distance, there will probably be nothing to be paid on this account, as the pipe will be carried under the travelled road. But if a Wooden pipe is used, it will be necessary to carry it in a different direction, over marshes and by the shore, by which the distance will be somewhat increased, but to no great extent. And in this case, land damages will probably be claimed. If these damages were to be measured solely by the *injury* done to individuals, they would certainly amount to but little. As experience, however, shows that they are not so measured, in similar claims made on the City, it is impossible now to estimate what the additional cost of the work, on this account, will be.

"With regard to the power of the City to supply these institutions from its present means, there is no doubt that a supply, amply sufficient for these and all other necessary purposes, is brought into the City at the present time. And, in reference to this subject, it may be worth while to state, that the quantity which can be delivered on the island, by the smallest of the proposed pipes, in a day, will be about the same that is used in each of the Fountains by the State House, in an hour, and the quantity which can be delivered by the largest pipe, at a height of sixty feet, in a day, will not much exceed that used by the two Fountains in Franklin Square every hour."

In the Report of the City Engineer, E. S. Chesbrough, to the Water Board, he says: "The distance, by actual measurement, from the end of the nearest Cochituate pipe in East Boston, along Saratoga Street, across the North Chelsea Bridge, and along the travelled road, generally, to the hill immediately north of the Almshouse, is 26,050 feet. A six-inch iron pipe could be furnished and laid this distance, at the present prices of iron, for $1.00 a foot, or $26,050 for the whole. About $1,000 should be added to this sum for the extra expense of flexible joints across Shirley Gut, dredging, etc.;

$700 for boxing across North Chelsea Bridge, to keep the pipe from freezing; and $300 for a Reservoir on the Island; making in all $28,050. By following the public road, all sources of land damages might be avoided.

"As on about 18,000 feet of the distance, wooden pipes might be laid to advantage, because they could be protected by salt marshes or salt water, considerable saving — at least $9,000 — might be made by adopting them. A four-inch wooden pipe would, in a few years, deliver as much water as a six-inch iron one, and in a purer state, because the latter would become partially filled by oxidation, while the former would probably be worn a very little larger.

"If Mr. Stodder's plan for crossing North Chelsea Creek, and Shirley Gut, with anchored gutta percha pipes, be adopted, a further saving of at least $1,500 might be made. How long these pipes would last, no one knows, and they would be somewhat liable to be disturbed. As you are aware, Blackwell's Island, N. Y., is supplied with Croton Water, through a pipe of this kind. The cost of one, is comparatively so small, that even a failure would involve very little loss.

"A small Reservoir on the Island would be necessary to retain a sufficient quantity for consumption, during such times as the supply pipe might require repairs. The cost of one, in earth, has been allowed for in the estimate. By reducing the size of the pipes to about two inches diameter, for which four inch pipes of iron should be laid part of the way, and using wooden pipes part of the way, as before suggested, with gutta percha crossings, and by delivering the Water only 40 feet above tide, the whole expense might be reduced to $13,750. The daily supply in that case, it is estimated, would be 12,524 gallons."

The annual Election of Members of the Cochituate Water Board took place April 14th, and resulted in the re-election of those chosen in January.

During the month of May, petitions were received from R. H. Eddy, Esq., for the free use of water for a Fountain situated in Exeter Place, and also one from the owners of estates on Louisburg Square for the same purpose. These were both referred to a committee, who reported, August 20th, that the petitioners have leave to withdraw, on the ground that the Board had no power to furnish the water free, but recommended that said fountain should be supplied on the payment of the regular rates.

June 7th, several complaints were received as to the bad taste of the water:

these were referred to the President to investigate, who reported that it was caused by the want of a thorough flushing out of the pipes all over the City, which was immediately attended to, and no further complaints were received.

Several petitions having been received, asking to have money refunded which had been paid for water, where the use of the same had been discontinued, it was voted that the Board had no power to refund a Water Rate, after the same had been paid.

October 8th, a communication from the City Engineer was received, stating that the large stopcock on the 36-inch main, at the head of Dover Street, was out of order, and to repair it would require the water to be shut off forty-eight hours; and to guard against accidents that might happen to the 30-inch main, he recommended that the 20-inch pipe which supplies South Boston, and the 12-inch pipe on Harrison Avenue, and also the 12-inch pipe now separated by the Worcester Railroad Bridge on Harrison Avenue, be brought together at an estimated expense of $600; whereupon it was voted to make the connection.

Notice having been received, on October 15th, of a leak in the East Boston Reservoir, it was voted, on the recommendation of the Engineer, that it be repaired by a coating of concrete, at an estimated expense of $1,250.

During the same month, on the 22d, a vote was passed to sell the Hyde Place, in Newton, *the estate on which the well that supplies the Newton Aqueduct is situated*, for the sum of $2,000, on the condition that the purchaser shall covenant not to do or permit any act which may injure the Reservoir, Well or Conduit of the Newton Aqueduct Company, or interfere with or lessen the supply of water in the same; the said covenant to be inserted in the deed which shall be given of the premises, and the City to reserve therein the right to enter for breach of the same.

Capt. Tewksbury reported, December 5th, that he had taken up 3,500 lbs. of the temporary lead pipe which was laid to convey the water to East Boston.

The Committee on Water recommended, on December 8th, that $100,000 be set aside to pay the excess of interest over income, and that this amount be put into the annual appropriation, which was referred to the next City Government.

During the month, the President and Henry B. Rogers were requested to draw up the Annual Report, which, on being presented, was accepted by the Board, and submitted to the City Council, Jan. 15th, 1852. It contained a full

description and history of the Water Works, in addition to the general Report of their transactions of the year, together with those of the City Engineer, Water Registrar, and Clerk of the Board, covering in all 118 pages. Three Maps accompanied the Report, one showing the whole line of the aqueduct; a general map showing the relative positions of the compensating Reservoirs; and a map showing the high service in the City, and the elevation of the door-sills, cisterns and points of delivery of the several dwellings in it.

In a Report of the City Engineer made July 23d, 1851, on the subject of the High Service, he says, after stating that a survey had been made of the district embracing the high service, "It has been ascertained that there are 22 houses above the maximum level of the Brookline Reservoir; of course, these never have been, and never can be supplied with Cochituate Water by the simple action of gravity; there are, besides these, 11 houses with their highest points of delivery above the level of the waste-weir of the Beacon Hill Reservoir, but not above the maximum level of the Brookline Reservoir.

"Of course, no promise was ever made to supply water at these heights. Between the level of the waste-weir and that of a point 8½ feet below, or 113 feet above tide marsh level, there are 53 points of delivery. These are the points which the City may fairly be considered under obligation to supply, at least eleven months out of the twelve, and which will probably often fail to receive a supply, if no special provision be made at the Beacon Hill Reservoir for the high service." He then suggests several plans; the one recommended was No. 3, which he describes as follows: "This plan requires in the Reservoir, on the end of the influent pipe, a stand pipe, say 30 inches in diameter, with a horizontal branch having a throttle valve in it. It is proposed to close this valve three hours out of the twenty-four. The effect of closing it would be to cause the water in the stand pipe to rise within a few inches of the height of the surface of the Brookline Reservoir, and consequently, to commence filling all the cisterns that could be thus reached; during the other twenty-one hours, the full capacity of the 30-inch pipe, with all the head existing at the time, would be enjoyed by all parts of the city." He estimates the cost of carrying into effect this arrangement at $1,400. For Report see page 263, Water Board Journal, 1851. (City Documents on the subject of Water, for year 1851, Nos. 37, 38, 40, 46, 54.)

# CHAPTER XVII.

## 1852 to 1855.

Questions as to the expediency of extending the Works into Roxbury — Excess of interest to be charged to construction — Election of Water Board for 1852, and their organization — Free use of Water for Fountains — Main Pipe on T. Wharf — Contract with Watermen for supplying the Shipping — Purchase of lot for a new pipe yard — Gates to the arches of Beacon Hill Reservoir — Drinking Fount on the Common. — Application for the purchase of Jamaica Pond Aqueduct — Annual Report of the Board for 1852 — Accretions on the Iron Pipes — Removal of the large Stopcock on Tremont Street — Water Rates assessed on the Public Buildings — Waste of Water — Shutting off Water from the Mains without notice — Election of Water Board for 1853, and their organization — Election of Water Registrar — Stable built — Offer for the Jamaica Pond Aqueduct property — Accretions on the Pipes — Night and Day Inspectors appointed — City Engineer requested to report on the expediency of uniting the Mains, and also on other subjects — Election of Water Board for 1854, and their organization — Ordinance for assessing Water Rates on the Public Buildings repealed — Offers for the purchase of the Jamaica Pond Aqueduct property — Settlement of the claims for diverting the Water — E. F. Knowlton appointed Superintendent of the Western Division — Possession of land in Osborn Place — Complaints of a bad taste to the Water, and the investigation as to the cause.

The question having been agitated as to the expediency of extending the Aqueduct into the City of Roxbury, the Mayor sent a communication to the Board, on March 29th, requesting their opinion as to whether the supply of water was adequate for such an extension; the cost and practicability of the work, and how the interest of the City would be effected in reference to its property in Jamaica Pond.

To this they immediately replied, that in the opinion of the Board, the present means of supply would not be adequate for the supply of Roxbury; that the Water Rents would not probably pay a fair interest on the cost, and that it would render the City's property in Jamaica Pond valueless.

The proposition of appropriating the sum of $100,000, mentioned in the preceding Chapter, which was referred to the next City Council on December

8th, was referred to the Committee on Water, and on their recommendation, it was voted, "that it is inexpedient to raise $100,000 by taxation to meet interest on water debt, but that the deficiency should be charged to construction."

On the 5th of April, 1852, Messrs. Thomas Wetmore, Henry B. Rogers, John H. Wilkins, Jonathan Preston, Adam W. Thaxter, Jr., Sampson Reed and Ezra Lincoln, were elected members of the Board for one year. They met, for organization, on the 7th; at which meeting, Thomas Wetmore was elected President, and Samuel Holbrook, Clerk of the Board.

A Petition was sent to the City Council, from the proprietors on Louisburg Square, City Document No. 24, 1852, complaining that the Cochituate Water Board had refused to supply water free for the Fountain in said Square, and stating that they "did distinctly arrange and agree with the late Mayor, and other members of the City Government, so far as any agreement could be made without special enactment," that if the Proprietors would at their own cost and expense, erect a marble fountain with all the necessary fixtures, that the City would grant the free use of the Cochituate Water, so long as an abundant supply should continue, and they therefore ask that said order may be rescinded. This communication was referred to the Board, who made their Report, April 19th, in which they argue the case at some length, but state that they have no power to grant the free use of water for any purpose whatever; and they refer the City Council to the opinion of the City Solicitor given in the year 1850, in consequence of the application of "The Children's Friend Society." See Part III., Chapter I.

On the receipt of this communication, the City Council recommended to the Board that the fountain be supplied at a nominal rate; and on May 22d, they voted to furnish water to play the fountain as often and as long as the Board shall think proper, during the present year, for $50; but on June 2d, this amount was reduced to $25.

Messrs. P. Sprague & Co. having made application to have a main pipe laid on T. wharf, it was voted May 7th, to lay said pipe on the condition, which was accepted, that the said Sprague & Co. secure the pipe against freezing.

June 9th, it was voted to renew the Watermen's contract for one year, from May 15th, with the following alterations, viz: they to pay over to the City, monthly, one-third of the receipts; that they be allowed to charge 37 ½ cts. for every 100 gallons, and that they shall not be obliged to furnish any quantity for less than 50 cts. On July 26th, it was further amended "that

they are also to supply water to vessels, excepting steamers, for washing decks, and to vessels on the stocks, for proving seams, at the same rates as has been or may hereafter be established by the Water Registrar." It was also provided, that if they should neglect or refuse to supply any vessel with water when required, for any purpose, the Board had the power to adopt such measures for supplying the same, as they might deem expedient.

Notice was received June 9th, that the Arsenal lot on Pleasant street, near Park Square, must be vacated; this estate had been used for a "Pipe Yard" ever since the works were commenced, and, as the Board had no power to purchase a lot for a new yard, notice was sent to the City Council, who passed a vote authorizing the purchase of a suitable lot; and, on October 6th, the offer of $1.50 per square foot, was made to Mr. Solomon Piper for a lot on Sea Street, now Federal Street, containing 9,192 $\frac{38}{100}$ feet: and, on the 22d, they purchased it for the sum of $13,784,57. Plans were immediately made for the present building, which were accepted November 3d.

During the year 1852, gates were ordered to be erected to the arches of the Beacon Hill Reservoir. A drinking font was directed to be put at the junction of Charles and Boylston streets. There was also an application from the City of Roxbury for the purchase of the Jamaica Pond Aqueduct, and the property was offered to them for the sum of $35,000, but was not accepted.

The Annual Report of the Board for the year 1852, contained a Map of all the pipes in the streets, showing the size of each, and the location of the hydrants and stopcocks.

The Report also contains very valuable information in regard to the accretions on the iron pipes, which we transfer entire to our pages as important for the future management of not only our own, but of all Water Works.

The Board say: Among the variety of topics noticed in the Report of the Engineer, deserving the consideration of the City Council, there is one which we consider to be eminently so. We allude to the effects which are found to be produced, on the inner surface, of all the iron mains and pipes, by the action of the water.

The attention of the Water Board was attracted to the subject, soon after its appointment; for although the pipes had then been in use less than three years, those effects were already quite obvious and striking, and in fact had been noticed some time previous. They have since then been carefully watched, and the valuable assistance of Professor Horsford has been engaged, for the purpose of ascertaining as far as is practicable, their origin, their probable progress for the future, and the means which might be relied upon, for the purpose of preventing, arresting, or retarding them. The two Communications of Professor

Horsford, describe with minuteness the present appearance and state of the interior of the mains and pipes, as does also the Report of the City Engineer.

The effects to which we now allude are the peculiar changes which have been produced on the iron itself; and they consist in

1. The absorption of the iron in certain places, and the formation in its stead of a substance resembling plumbago.

2. The gradual development of local accretions or tubercles, in the interior of the pipes, by which the flow of water is impeded, and their capacity diminished, so that the object for which they were laid becomes imperfectly accomplished, and an apprehension is excited that they may be so far closed up as to be useless hereafter.

This subject has received but little scientific investigation, till within a few years, notwithstanding its very obvious importance, and although the evils must have existed ever since cast-iron has been used for such purposes. It is one, however, of no little importance to the City, as there is involved in it the question of the present and future capacity of all the iron pipes which have been or are to be laid, at no small expense, and of their consequent adaptation to the purpose for which they are used, and also of their ultimate durability. The Water Board have therefore thought that it would be interesting and useful to lay before the council somewhat in detail, not only the present condition of the pipes belonging to the Water Works of this City, in relation to the subject; but also the result of such inquiries, as they have been able to make, into the extent of the same evils in other places, and the efforts which have been made to ascertain their nature and origin, and to provide a remedy for them, and the success of those efforts.

The first notice taken of this subject which we have seen, appears in the transactions of the French Academy of Sciences, for the year 1836 (*Comptes Rendus*, *v.* 3, *p.* 131). It is a note by *M. Vicat on the subject of a coating to prevent the development of Tuberculous accretions in cast-iron pipes for conducting water.*

He states that a report, printed at Grenoble, November 22, 1833, by order of the Municipal Council, called the attention of the public, to the rapid, as well as unforeseen, filling up of the large cast iron main, of the *Chateau d'Eau*, in that town. The formation of numerous tubercles of hydroxide of iron, began to show itself, shortly after the water was let on, by a perceptible, though slight diminution of the discharge. The development of the accretions, however, as was proved by many accurate measurements, soon increased so much, that the supply of the *Chateau*, which had been in 1826 about 1400 litres (about 370 wine gallons) a minute, was gradually reduced in 1833 to 720 litres, (about 190 wine gallons,) showing a loss of nearly one-half. A good deal of alarm was excited by it, and an attempt was immediately made by eminent chemists, to ascertain the cause, and reconcile the phenomenon with various theories. A commission, consisting of Engineers and others, was also appointed which discussed at Grenoble, the means of destroying this kind of ferruginous vegeta-

tion (as it is called in the Report), or arresting its progress. In the mean time new measurements indicated that in less than five years the pipes would probably be so obstructed that the water would cease to flow through them. Two members of the Commission, Messrs. Guemard and Vicat, Engineers in chief, being persuaded that the tubercles were formed at the expense of the castings, applied themselves to the discovery of some coating, which would be at the same time, cheap, indestructible, and capable of preventing oxidation. After two years of experiments, they considered it sufficiently proved, that hydraulic cement applied about $2\frac{1}{2}$ millimetres thick (0.0984 in.) is of all compositions, combining facility of application and cheapness, that which adheres the best to the castings, is the most indestructible, and prevents most effectually all oxidation, and consequent formation of the tubercles. With this composition, they recommended that the interior of the mains should be washed over, by means of a sponge, proportioned in size to the diameter of the pipe.

M. Vicat also states that, owing to unforeseen causes, the tubercles on the grand Conduit for supplying the fountains appeared to have reached their limit of development, as several exact and careful measurements which had been made in May 1836 left no doubt of the fact. He says, therefore, that it might be affirmed they were then stationary. He raises a question, however, as to their continuing so, for the future.

In the same volume (p. 462), there is an extract of a letter from M. Prunelle to M. Arago on the subject of the tubercles which had formed in the pipes of the conduit at *Vichy*. Those pipes, which were gray castings, had been laid twenty-six years previous. The quantity of water from them had diminished from day to day, and among other obstacles to its passage, they at last discovered tubercles as large as hens' eggs. The water passing through them was found not to contain a trace of iron.

And there is also one from *Sir John Herschel* to *M. Arago* (p. 506), which mentions, that pipes for conducting water, at the *Cape of Good Hope*, were affected in the same way as those at Grenoble, and that the difficulty had been remedied by a coating of Roman cement.

In the transactions of the same Academy for the next year, (*Comptes Rendus*, 1837, *v.* 4, *p.* 190,) there is a Report from a Committee on a memorial offered by *M. Payen*, on the subject of local concretions or tubercles, in iron water pipes. The following is the result of M. Payen's experiments and reasoning: Waters which have a feeble alkaline reaction possess the property in presence of air and sea salt, of producing on wrought or cast iron which they moisten, local concretions, which preserve the remainder of the surface free from all change. And these effects vary according to the proportion of the different salts, the breaks of continuity, and the foreign bodies adhering to the surface of the metal. That to this cause may be attributed the concretions in the pipes at Grenoble, the waters at that place having a feeble alkaline reaction, owing to the presence of carbonate of lime, and being slightly alkaline. And that it may be concluded, that

wherever there is a want of homogeneity in cast-iron pipes, which convey water slightly alkaline and saline, tubercles will be found at the points where heterogeneity exists.

An analysis of the accretions gave the following results: —

| | |
|---|---|
| Protoxide of iron, | 0.210 |
| Peroxide of iron, | 0.582 |
| Carbonic acid, | 0.050 |
| Water, | 0.145 |
| Silica, | 0.013 |
| | 1.000 |

In 1837, the subject attracted the attention of the *British Association for the Advancement of Science*, and under its auspices, a very elaborate investigation of the action of air and water, whether fresh or salt, clear or foul, and at various temperatures, upon cast-iron, wrought-iron and steel, was made by Mr. Robert Mallet. Mr. Mallet commenced in 1838, and continued until the year 1843, a very complete course of experiments on the subject. They were made on eighty-two different sorts of iron, (chiefly cast-iron,) immersed in clear and foul sea water and clear and foul fresh river water, for two different periods, the first period occupying 387 days, and the last, 732 days; and, at the end of each period, the specimens were taken up, carefully examined, and weighed. The results of the experiments, and Mr. Mallet's deductions therefrom, were communicated, from time to time, to the Association, in three Reports made by him, which were published in the Reports of the Association, for the years 1838, 1840 and 1843.

In his first Report, which is devoted to the consideration of the then existing state of chemical knowledge of the subject at large, he remarks, that notwithstanding the innumerable uses to which iron had been applied, for the purpose of supplying the social wants of man, during the preceding half century, yet our information on the subject of its durability, and the causes likely to impair or promote it, was scarcely more advanced than it had been twenty years previously, and that while the chemist was not precisely informed as to the changes which air and water produce on it, the engineer was without data to determine what limits the corroding action sets to its durability. Nor was it known with certainty, what properties should be chosen in wrought or cast iron, that its corrosion might be the least possible, under given circumstances. Neither was our actual knowledge more advanced as to the variable effects of corrosive action, on the same iron, of different waters, such as are commonly met with, containing their usual mineral ingredients in solution (exclusive of the better understood cases of *mine-waters*).

The investigation was therefore undertaken for the purpose of throwing light on these topics, and there was of course involved in it a great extent of inquiry into the durability of the metal, the forces which were likely to impair it, the

mode in which these forces would act, what would be their results, and the means of arresting their progress.

The Board can merely state some of the general laws regulating the action of fresh water on iron pipes which Mr. Mallet considers as previously known, or established or confirmed by his experiments.

He found that any sort of iron, cast or wrought, corrodes when exposed to the action of water holding air in combination, in one or other or some combination of the following forms, viz: 1. *Uniformly*, or when the whole surface of the iron is covered uniformly with a coat of rust, requiring to be scraped off, and leaving a smooth red surface after it. 2. *Uniformly with plumbago*, where the surface as before uniformly corroded, is found in some places covered with *plumbagenous* matter, leaving a *piebald* surface of red and black after it. 3. *Locally*, or only rusted in some places and free from rust in others. 4. *Locally pitted*, where the surface is left as in the last case, but the metal is found unequally removed to a greater or less depth. 5. *Tubercular*, when the whole of the rust which has taken place at *every point* of the specimen has been transferred to one or more particular points of its surface, and has there formed large projecting tubercles, leaving the rest bare.

The great elements of difference of corrosion as respects the iron itself appear to be:

1. The degree of *homogeneity* of substance of the metal, and especially of its surface.

2. The degree of *density* of the metal, and state of its crystalline arrangement.

3. The amount of *uncombined carbon* or suspended *graphite* contained in the iron.

And therefore that the more homogeneous, the denser, harder, and closer grained; and the less graphitic, the smaller is the index of corrosion.

In fresh water combined with air, corrosion proceeds fastest in water from 175° to 190° Fahrenheit.

And it is in direct ratio with the volume of air, —

And ceases entirely in water deprived of air.

Fresh water may hold so much combined air, (not to speak of carbonic acid,) as to act more rapidly than sea water. *Carbon* as it is known exists in iron as diffused *graphite* in a crystalline form, and as *combined carbon;* the dark gray and softer irons contain more of the former; the lighter and harder irons, more of the latter. Now the latter kind have the property of being much less uniform or homogeneous in surface when cast under similar conditions, than the former; while the highly graphitic irons, though more uniform in large specimens, are the least dense and softest in texture: hence, the bright gray irons of high commercial marks, the Nos. 1 and 2, while they are the most valuable for construction, are also the most durable. And, in general, the result of the experiments show that cast-iron with low commercial marks, the Nos. 3 and 4, etc., corrode

locally and generally become pitted, while the high marks, 1 and 2, etc., corrode with considerable uniformity over the whole surface.

The *rate of corrosion* is a decreasing one, at least when the plumbago and rust first formed has been removed. When, however, this coating remains untouched, the rate is much more nearly uniform, and is nearly proportional to the time of reaction, in given conditions. In some cases, even where the coating had been removed, an increment in the rate had taken place. And it is observable that this almost uniformly occurred in those specimens which had the smallest amount of corrosion at their first immersion. Thus there was a tendency to a greater equality in the index of corrosion in all the varieties of iron at the second than at the first immersion.

*Homogeneity* of surface and texture, or the contrary, are by far the most important circumstances which vary the amount of corrosion of cast-iron by air and water.

And the rapidity of this corrosion is not so much dependent upon the chemical constitution of the metal, as found in commerce, as it is upon the state of molecular arrangement and the condition of its constituent carbon.

It is certain that the *blackest cast-irons*, viz., those which contain the largest quantities of uncombined carbon or graphite in a mere state of mixture, are acted upon by water and air the most rapidly. *The gray or mottled iron* as containing a less quantity of uncombined carbon, and having a denser structure, is less acted upon. And the varieties of iron which present scarcely any symptoms of a crystalline texture at all, but still are grained or mottled, are those which are the least susceptible of alteration or decay.

*Chilled cast-iron*, of every sort, upon the whole, corrodes faster than the same sort of iron cast in green sand. And this is owing to the greater want of homogeneity, in its surface, than in that of any other sort of casting, by which the voltaic action produced at its surface, increases the corrosion to a greater extent, than its great density and hardness and small amount of uncombined carbon are capable of retarding it, compared with other sorts of cast-iron. When, however, iron moulded in sand is exposed to corrosion, this takes place with considerable uniformity over the whole surface. But in chilled castings, the largest portion of the surface remains unchanged, and the corrosion is nearly or wholly confined to certain spots, and gradually produces large tubercular concretions.

The size, and perhaps the form of iron casting, forms one element, in the rate of its corrosion in water. Because the thinner castings having cooled much faster and more irregularly than the thicker, are much less homogeneous, and contain veins and patches, harder than the rest of their substance; hence the formation of voltaic couples and accelerated corrosion.

He estimates that from three-tenths to four-tenths of an inch in depth, of cast-iron one inch thick, and about six-tenths of an inch of wrought iron, will be destroyed in a century, in clear water.

He also states that the officers of the French artillery, after a number of experiments, found that the corrosion of iron by air and water, is greater in proportion to the purity and goodness of the coke, with which the iron is made, and that it is altered less, when made with charcoal, than with coke; and that iron cast in dry sand, or in loam moulds faced with charcoal, oxidates much less speedily than when cast in green sand; and that chilled cast-iron, or that cast in iron moulds, is least of all susceptible of the change.

As to the nature and origin of the peculiar change which takes place in the conversion of part of the metal into an entirely different substance, but little information, beyond what was already known, can be obtained from these reports. It is stated in the introductory one, before the result of the experiments was ascertained, as a fact, first observed by Dr. Priestley, that cast-iron being immersed in sea water for a length of time has its metal wholly removed, and becomes changed into a substance analogous to plumbago, mixed with oxide of iron, which frequently, though not invariably, possesses the property of heating and inflaming spontaneously, on exposure to air; but that it is yet by no means clear, how it is produced, what is its precise composition, and to what is owing its rise of temperature on exposure to air; that malleable iron, under circumstances but little understood, is also subject to this change; and also from various statements of others, it would seem that both malleable and cast-iron are affected in the same way, when immersed in water holding in solution alkaline or earthy salts or acids.

The subsequent experiments throw no new light on the cause and nature of this singular phenomenon. They show, however, that the same effect is produced by the action of air and fresh water; and this is too well corroborated by our own experience.

In regard to the opinion expressed by M. Vicat, that the tubercles at Grenoble were *stationary*, he remarks, that it must be obvious that the rate of increment of these must be a decreasing one; but that he does not perceive anything to set a limit to their accretion, except the stoppage of corrosive action. *Mr. Mallet* considers that in *tubercular corrosion*, the whole of the rust which has taken place, at *every point*, is transferred to one or more particular points, and thus forms the projecting tubercles, leaving the rest of the surface bare. The sole essential circumstance to tubercular corrosion, he states to be *the want of homogeneity*, in the metal corroded; and he therefore controverts the opinion of *M. Payen*, before cited, that the cause of the phenomenon is partly to be attributed to a slight alkaline reaction of the corroding water. This peculiar effect, too, is confined to chilled or unequally cooled cast-iron, to mottled iron, and to damasked wrought-iron, or that of mixed constitution; and in all, it appears to result from heterogeneity of composition, and it is therefore unnecessary to call in, to aid the explanation, the preservative action of alkaline solutions.

The important problem of *preventing the corrosive action* of the water, by

coating the interior surface of the pipe, was a principal object of Mr. Mallet's experiments. He did not, however, discover any thing which would have the desired effect. Of ten kinds of paints and varnishes, laid on with great care, not one would completely prevent corrosion for a single year — or remain perfectly adherent or undecomposed for that time. With regard to M. Vicat's proposition, previously stated, (in the *Comptes Rendus*, v. 3d, p. 181,) of coating the pipes with hydraulic cement, he thinks that though this would no doubt for a time diminish corrosive action, it is much to be feared it could have but little permanence, when the current was rapid, and, should the water contain much earthy matter, the tendency of *this* to deposit and adhere to the pipes, must be fatally increased.

The various results of Mr. Mallet's experiments are exhibited in a full series of tables, which present to the Engineer, as he thinks, " sufficient data to enable him to predict the term of durability, and allow for the loss by corrosion of iron in all conditions, when entering into his structures."

The last information, to which we shall refer on this subject, is contained in a paper on *Tubercles in Iron Pipes, by M. Gaudin, Engineer of Bridges and Roads*, published in the *Annales des Ponts et Chaussees, for November and December* 1851. He states that the iron conduit at Cherbourg, constructed between the years 1836 and 1838, of white casting, about 2460 metres (nearly $1\frac{1}{2}$ miles) long, had become everywhere coated with tubercles, which, in some places, had an elevation of from 4 to 5 centimetres, (1.575 to 1.968 inches,) so that the orifice of the pipe which was, when laid, 18 centimetres (about 7 inches) in diameter, had been reduced to less than one-third its original section. The consequence of the diminution of the orifice, joined to the enormous loss of head occasioned by the additional friction, had deprived many of the workshops at the end of the conduit of a supply, prevented the simultaneous playing of the fountains, and made the supply of the grand Reservoir impossible, or very feeble.

The tubercles were very broad at their base, and very strongly adhering to the surface of the pipe, and could not be removed, except by heating the pipe to a red heat, or by a forcible action of an instrument. They were of a greenish brown color, and testaceous structure, and, on exposure to the air, assumed the color of yellow ochre, a sure sign of the oxidation of part of the iron which entered into their composition. Their density was almost 3.362. A chemical analysis gave the following results: —

Peroxide of iron, 96 to 98.

Silex and Alumine (argil) 4 to 2.

Chloride of Sodium — traces.

Sulphate of Iron — traces.

They were, therefore, almost entirely free from (at least as far as regards the iron which they contained) the elementary matters contained in the water in solution; and, indeed, they were not derived from substances which it could hold in

solution. The water was free from color, taste or smell, and its specific gravity nearly that of pure water. It showed, on analysis by chemical tests,

A very small quantity of carbonic acid.

A small quantity of calcareous earth.

A small quantity of sulphate of soda.

A positive quantity of chloride of soda.

Little or none of the metallic salts.

And little or no iron.

A more recent analysis of the water, taken before its passage through the Conduit, showed its density to be scarcely different from distilled water; to reagents it only showed chlorides, and those, chlorides of sodium; there was no trace of lime, nor sulphates, nor iron.

He considered it certain, that the iron in the tubercles was to be attributed exclusively to an alteration which had taken place in the pipes themselves, no matter what the casting might be, whether white or gray. And as, notwithstanding this alteration, there could not be seen in the pipe, even with a glass, after it had been well rubbed, any difference between its texture and that of new casting, he concludes that the deterioration must have taken place over the whole surface indiscriminately, in the same way. He calculates that the greatest thickness of the layer which could have been thus removed in thirteen years was 0.0025 metre (0.0098 inch); or 0.0002 (0.00075 inch) annually.

In reference to the obtaining some remedy for the evil, he observes, that waters the most pure and most proper for the ordinary necessities of life afford no exemption, since it appears invariable that the tubercles are in an especial manner developed by the presence of very small quantities of sea salt, which almost all waters contain. And that chemists and engineers have therefore recommended the forcing of linseed oil by great pressure into the metal, and also coatings of mortars and hydraulic cements and bituminous coverings. There was a great limit, however, to the efficacy of all of them. At Cherbourg, pipes which had been laid down not more than three years previous, and which had had linseed oil forced into them by hydraulic pressure, already showed traces of tubercles, some of which had attained an elevation of 4 and 5 millimetres (0.157 to 0.197 inch).

Coatings of mortars and hydraulic cements cannot be applied without great difficulty, and must be in very thin layers; and the whole surface is therefore not covered, leaving points where the tubercles are developed. Bituminous coatings could indeed be applied by immersion in hot baths composed of those substances, but these means, if efficacious for a time, must have their limit, when the friction of the water shall have worn away the thin covering; and then the same difficulty would be felt as before. (See page 220, for the experience of bituminous coating in Cochituate Pipes.) He thinks, therefore, that the only means on which could be placed a hope of certain preservation of the iron, would consist in the discovery of some compensating agent against the magnetic or chemical action which causes the formation or development of the tubercles, and that the agent em-

ployed should not affect the quality of the water, and that its application should be simple and not expensive. Such an agent, however, had not been discovered. Mr. Gaudin then proceeds to describe his mode of removing the accretions by mechanical means from time to time when it should be necessary. A description of the process will be found in the report of the City Engineer, 1852, p. 166. See p. 183.

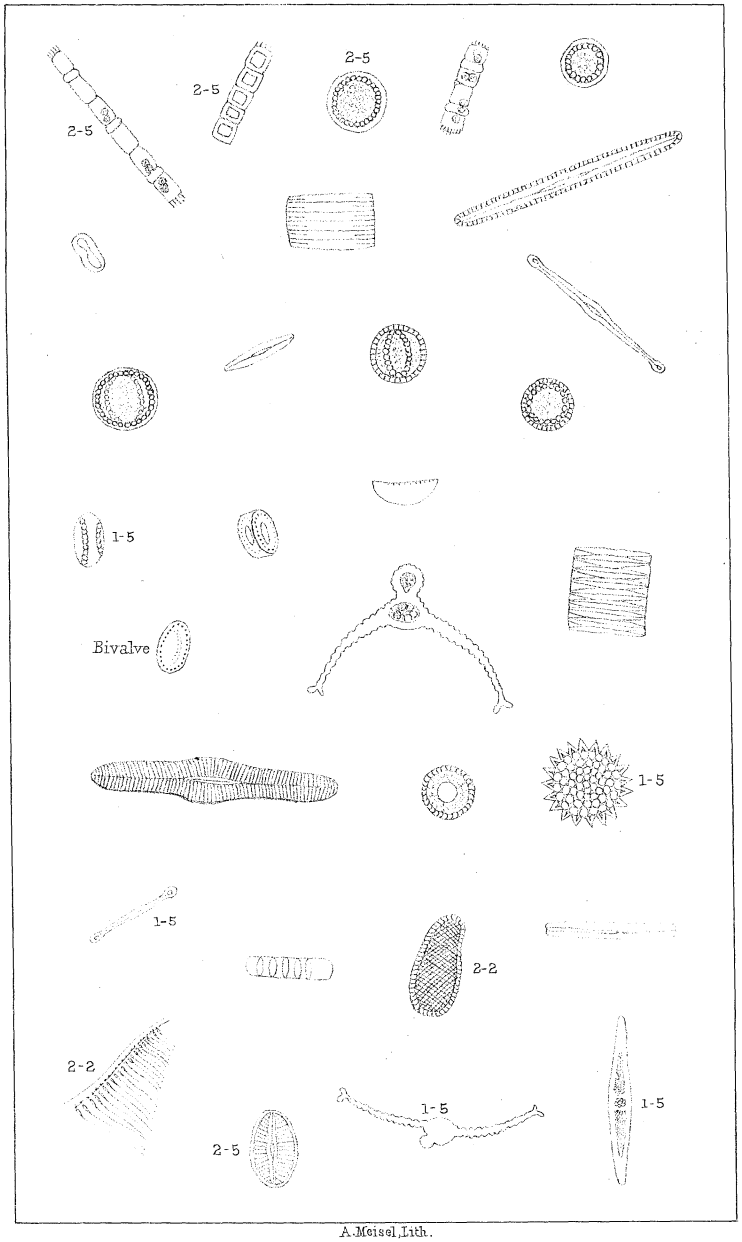
The foregoing statement contains a very brief analysis of the investigations which have been made, in other places, of the nature, origin, and mode of remedying the evils now under consideration, so far as they have come to our knowledge. We annex to it the able and interesting communications of Professor Horsford, and refer to the report of the City Engineer, to show the extent of our own experience in relation to them.

It has been hoped that by bringing to the notice of the Council all the facts which we have been able to accumulate, and offering even an imperfect sketch of the researches made on the subject, we might enlist the attention not only of those who are similarly interested with ourselves, but also of men of science, and of those who are engaged in the production of the metal itself, or in the great variety of manufactures and constructions in which iron is employed. And that if this object could be effected, it might be the means of ascertaining hereafter some mode either of preventing the evil in its origin by improvements in the castings, or of arresting or retarding its further progress by the intervention of some preparation for covering and protecting the surface; or, of obtaining a temporary remedy by providing a mode of removing the obstructions as they from time to time appear.

Undoubtedly, the most important change which takes place on the inner surface of the pipes, as far as relates to any immediate results, is the production of the accretions. The formation of plumbago or something like it, in the place of the iron which has been absorbed, does not indeed protect the metal beneath it, and the action continues, perhaps even with a slightly accelerated force; but, according to the French and English authorities, its progress is so slow that many years must elapse before any serious consequences from it alone would be likely to happen. It is probable that the only way to prevent this action will be found, in coating the surface with some composition which will shield it. We cannot anticipate what success may attend future attempts to discover such a composition; up to the present time, we believe, they have all been quite fruitless.

But, with regard to the accretions, their growth has been more rapid and important, so much so, that our 36-inch and 30-inch mains have become already, in consequence of the actual diminution of their area and also of the additional friction which has been occasioned, scarcely superior in capacity to those of 34 and 28 inches, having a clean surface; and we have had sufficient experience on the subject to convince us of the impolicy of making use of wrought-iron service-pipes at all, or of cast-iron ones, of less than 4 inches in diameter.

We cannot indeed, at present feel any certainty as to the extent to which the tubercles will ultimately increase, and think there is some prospect that they




A.Meisel,Lith.

Microscopic delineations of organisms found in the ochreous deposit on the interior surface of the Iron Pipes.

may become stationary, or at least have their progress much retarded. As their origin is, however, attributed by the English authorities solely to the constitution of the iron itself, and by the French, and to some extent by Professor Horsford, partially to the same cause, it is possible that improvements may be made in the manufacture of the metal, or the casting, by which it may be rendered more homogeneous, and their formation be thus prevented; and, in the mean time, reference may be had to this quality of the metal in selecting the castings, whenever it shall be possible.

It is the intention of Professor Horsford, if he can do it consistently with the performance of his other duties, shortly to obtain an analysis of the iron, from our own pipes, where an unlike tendency to accretions is noticed; which may throw some light on the point of homogeneity.

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## FIRST REPORT OF PROFESSOR HORSFORD.

CAMBRIDGE, Jan. 14th, 1852.

THOS. WETMORE, Esq.,

*President of the Cochituate Water Board.*

DEAR SIR, — In reply to your favor of the 5th instant, in relation to the accretions in the Cochituate iron mains, I have to regret that my investigations thus far have thrown but little light upon the question of most importance; to wit, *How far will these accretions extend?*

A brief statement of the present condition of the pipes will show the bearing of this inquiry.

At the two points near Dover Street, where one of the main iron pipes was taken up for repairs in the last autumn, there were found, upon the interior surface of the pipe, nodules varying from half an inch to three inches in diameter at the base, and having a height of from one-quarter to a little more than half of an inch. Some of them were of a reddish, others of a dirty yellow color, and those of each color invariably in a group by themselves. They presented concentric structure within, and rested in many cases upon slightly elevated portions of the surface of the pipe. These elevated portions were co-extensive with the inferior surface of the nodules, were of a dark brown color, and crumbled at once to powder upon being scratched with a knife.

Portions of the surface of some sections of pipe were quite free from accretions. In some areas, the accretions were small; in others, most were large. There seemed to be no tendency among them to gather upon the bottom rather than upon the top and sides.

Upon placing one of these nodules in warm hydrochloric acid, the reddish and yellow part dissolved to a dark red solution, leaving a white jelly-like residue, which, under the microscope, appeared an amorphous inorganic mass. Chemically

examined, the latter proved to be silica, and the red solution, iron. A quantitative analysis of the whole, gave

| | | |
|---|---|---|
| Peroxide of iron, . . . . . | = 91.74 | per cent. |
| Silica, . . . . . | = 1.28 | " " |
| Water, trace of organic matter, and loss, . . | = 6.98 | " " |
| | 100.00 | |

The yellow nodules, upon being heated, became red. As all the nodules had been subjected to heat in melting out the lead connections between the sections of pipe, it was evident that the difference in color was to be ascribed solely to the unequal heat to which the red and yellow nodules had been exposed. This explained the occurrence in such well defined groups, of the nodules of either color.

The suggestion that the accretions might be due to the growth of some kind of vegetation, in which were lodged particles of the ochreous matter in suspension in small quantity in the Cochituate water, and which gives to it, its occasional faint wine color, which is found on the bottom of the tunnel, and which accumulates in the filters, was not sustained by microscopic examination. The ochrey deposit is composed of organisms, of which the accompanying card contains several of the best defined and more remarkable forms.* Of these, only an occasional one is found in the accretions.

There are reasons for believing the slight elevations of surface observed immediately beneath the accretions to be due to changes in the texture of the iron arising from the growth of the accretion, and not to an original irregularity of the casting; and further, for believing that the accretions are indebted for their iron to the surface upon which they rest, and not at all, or but very slightly, to the water which flows over them.

I have wrought iron pipes of $1\frac{1}{2}$ inches calibre, which are coated with accretions interiorly, and which, in twelve months, have been eaten through from within outward, by the circulation of cold Cochituate water. I have others of the same diameter, which, in three months, have been eaten through by the circulation of hot Cochituate water.

I have another pipe, one inch in diameter, which in twelve months was so nearly closed by accretions throughout its entire length, that it was removed because it ceased to serve water.

I now return to the inquiry, *How far these accretions extend?*

The inquiries and personal inspection of the Engineer and President of the Water Board, made in New York, Philadelphia and Baltimore, the fruits of which have been kindly placed at my disposal, have shown: —

1st. That similar accretions occur in the iron mains of all the above named Cities.

*The numbers refer to the eye pieces and objective of the microscope employed, — an Oberhauser in the possession of my friend and pupil, Mr. John Dean, to whom I am indebted for these figures.

2d. That in Philadelphia, the accretions, now after a lapse of thirty-seven years, are too inconsiderable to be the occasion of any present or future solicitude.

3d. That those in Baltimore and New York, though somewhat more extensive than in Philadelphia, are still so much inferior in size and number, especially when we compare the three years service of the Cochituate Water with the ten of New York, and the still longer period of Baltimore, that the indefinitely long prospect of unobstructed distribution in New York and Baltimore, based upon their experience so far, does not throw the desired light upon the future of the Cochituate iron mains.

One fact, of particular moment in this connection, has come to my knowledge. A gentleman of my acquaintance, accustomed to careful observation, remarked on a visit to Versailles, sections of iron mains of a foot in diameter, more than half filled with this kind of accretion. I hope soon to hear more particularly in regard to the attendant circumstances of this case, and also to learn more of the experience of the old world in the use of iron mains.

The solicitude lies in two directions. In the first place, the accretions diminish the serving capacity. Taking the present average thickness of the incrustation at three-eighths of an inch, the serving capacity of a pipe 36 inches in diameter is reduced by the amount of an area of $42\frac{3}{8}$ square inches, which is equal to a cylindrical pipe 7.3 inches in diameter. If we conceive the accretion to go uniformly forward at this rate of $14\frac{1}{8}$ square inches per annum, it would become a matter of immediate grave consideration. In the second place: the accretions are formed at the expense of the iron upon which they rest. With their increased thickness will come, at a remote period, diminished strength of the iron.

I understand there are but few cast-iron pipes in the city distribution, of less than six inches calibre. It may be that the more rapid flow in these generally, will impede the growth of the accretions. It may be that after the accretions shall have coated the whole interior of the pipes, and attained a certain moderate thickness, their further growth will be much slower, if not altogether arrested.

With my present knowledge, I do not feel prepared to say that there is any substantial ground of alarm in view of the incrustations upon the iron mains. At the same time, I cannot affirm that there may not be some reasonable solicitude, and I shall not fail to make myself acquainted with the subject, as the illustration goes daily forward before us, as well as with what has been elsewhere observed in the same field.

I am very respectfully,

Your obedient servant,

E. N. HORSFORD.

## SECOND REPORT OF PROFESSOR HORSFORD.

CAMBRIDGE, JANUARY 10TH, 1853.

THOMAS WETMORE, ESQ.,

*President of the Cochituate Water Board.*

DEAR SIR, — Since the date of my former letter to you, I have been enabled, through the co-operation of the City Engineer, to assure myself of the steady growth of the accretions in the Cochituate iron mains. Plaster casts, taken in various localities and after unequal times from the laying down of the pipes, exhibit, in the relative sizes of the nodules, satisfactory evidence upon this point.

Some consideration has been bestowed upon the various agencies that have been suggested, as operating to promote the growth of the accretions. Of these, a prominent one has been the presence of *inorganic salts in the water.*

It might be presumed, that the surface-water of a region of country which is from time to time visited by rains, during the prevalence of a strong wind from the sea, would contain more or less of the ingredients of sea-water. The rain-water, falling at Paris and at all points to the eastward as far as Frankfort on the Maine, gives the reactions of common salt. Farther east, at Munich, rain-water does not show these reactions. The chloride of sodium and the other saline matters of the ocean, brought by east winds over the basin drained by Cochituate lake, would, on being precipitated by rainfalls, confer on the water, it is conceived, power to act upon the iron pipes. But if we unite what comes from this source with what is supplied from the soil, both together leave the Cochituate so remarkably pure that rain-water is scarcely to be preferred for any purpose whatever; and its effect on iron pipes from this cause must be quite inappreciable. When we compare its action with that of the Croton and Schuylkill waters, we ought to find the accretions in number and size proportionate, in some degree, to the amount of salts the waters severally contain. These are as follows: —

*In one hundred thousand parts.*

| | Croton. | Schuylkill. | Cochituate. |
|---|---|---|---|
| Solid residue, | 18.71 | 9.42 | 5.35 |
| Inorganic, | 11.34 | 7.29 | 2.90 |
| Organic, | 7.37 | 2.13 | 2.45 |

According to this table, and the view above expressed, we should find the accretions, in magnitude and number, in the order of Croton, Schuylkill and Cochituate.

In reality, no regard is paid to this succession. Facts give Cochituate the first rank, and Schuylkill the last.

The above quantities do not, however, represent the relative amounts of Chlorides, which are the more efficient salts in promoting the accretions. These are

contained in the following proportions: — (Silliman's Report to Water Commissioners.)

| | Croton. | Schuylkill. | Cochituate. |
|---|---|---|---|
| Chloride of Sodium, | 0.167 | 0.147 | 0.032 |
| " " Potassium, | trace | | 0.038 |
| " " Calcium, | 0.153 | | 0.031 |
| " " Magnesium, | | 0.009 | 0.076 |
| " " Aluminium, | 0.372 | | |
| Total, | 0.692 | 0.156 | 0.177 |

According to this table, the Croton should stand first, and the Cochituate occupy an intermediate rank.

The most striking peculiarity of the Cochituate water is, as already mentioned, its remarkable purity and, of course, its superior capacity for holding air in solution. From the well known joint action of air and water in rusting iron, this characteristic may fairly be entitled to a share of influence in promoting the accretions. That it is not the only or the most prominent cause, will be apparent from the following considerations.

1. Among the results of experiments by Meyer (J. Tech. Chem. X. 833) are the following: —The rusting is impaired by the smoothness of the surface, by hardness, by the contact of zinc, and by the presence of carbon as in cast-iron. It is promoted by roughness, by purity of the metal, and by the presence of sulphur. Payen (Ann. Chem. Phys. L. 305,) confirmed by experiments the observations of Wetzlar, that alkaline waters protect the iron. By neutralizing any acid the waters might contain, and thus preventing the first coat of oxide from going into solution, it leaves the iron protected by a shield of its own rust. This author also found, that the *gray* variety of cast-iron oxidated more readily than the *white*. (Ann. Chem. Phys. LXIII. 405.) These observations have been confirmed by researches undertaken by the British Association, which have, I know, fallen under your notice.

2. It was observed in taking casts of the nodules, that areas of many square inches and in some instances, of several square feet, were free from accretions, while immediately around, they were found in great profusion. In some sections of pipe, only large nodules had taken root, and these were quite uniformly distributed. In others, those only of lesser size were found, and they were quite closely arranged.

3. In situations, where other metals could exercise influence, the nodules had been most manifestly governed in their position and number by the proximity of the other metals. This was especially apparent in the well defined disk of accretions on the plain iron surface, opposite the large composition circular valves of the mains, which were taken out for repairs in the course of last year and the year previous.

It is manifest from the above considerations, that there has been *galvanic*

*action*, arising in one class of cases, from the contact of metals of unlike affinity for oxygen, and generally from a *want of homogeneity* of the iron, and I feel strongly induced to coincide in the opinion, that to this, more than to any other agency is to be ascribed the rapid formation of accretions in the Cochituate iron mains. It might be worth while to see how far this view, which has been arrived at, as well from observations in the old world, as with us, will be sustained by a comparison of analyses of fair sample specimens of the iron from the mains of Philadelphia, New York and Boston, and this I hope to lay before you in the course of the coming summer.

I regret that my health has been such during the last twelve months, as to prevent the more extended investigation of this whole subject of accretions upon iron mains for the service of water, which I had projected last year. I regret this the less, however, since learning that you have become possessed of the ablest researches that have been made in this field; for I feel that, however industriously I might have pursued the matter in developing the influence of local peculiarities, I could scarcely have hoped to add to the practical information already in possession of your office.

I am, very respectfully,

Your obedient servant,

E. N. HORSFORD.

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## REPORT OF THE CITY ENGINEER.

*Brick Aqueduct and Structures between the Lake and the Brookline Reservoir.*

Last Spring, the interior of the aqueduct received a thorough cleansing throughout its whole extent, which it needed very much. A peculiar substance, like very fine dark mud, is deposited upon the surface of the brick work, and adheres for a time, but in consequence of changes in depth and velocity of the current through the aqueduct, this substance sometimes comes off in sufficient quantities to give to the water the appearance of being filled with sawdust. In order to prevent troublesome accumulations in the aqueduct, and particularly in the tunnels, where the irregularity of the sides causes an unusual amount of deposit, it is necessary to cleanse it out, partially at least, twice a year. Last spring, a number of bunches of extremely attenuated and delicate roots were discovered hanging from the top and sides of the aqueduct between the Newton and the Brookline Tunnels. In some instances they were three or four feet long, but so tender as to break with the slightest force, and of course, very easy to remove.

In the autumn, a great many patches, in some cases larger than the crown of a man's hat, of a vegetable substance like sponge in color and texture, and frequently with coral-shaped branches several inches in length, were discovered in the first mile of the aqueduct, being most numerous near the Lake. They were

very tender, and easy to remove. It is a little singular that this should be the first instance of discovering them in the aqueduct, as precisely the same species of plants, apparently, was discovered in the large stopcocks that were taken out of the pipe in Tremont at the head of Dover Street, to be repaired, more than a year ago.

The rapidity with which the interior surfaces of some of the pipes have become covered with *tubercles* or rust, has excited a great deal of interest, and has been the subject of much observation; but the cause of such a wide difference in the growth of these tubercles in different pipes, and in different places, does not appear to be clearly understood. All the large pipes that have been opened have been partially or entirely covered on their inner surfaces, some with detached tubercles, varying from a half to two and a half inches base, with a depth or thickness in the middle, of from one quarter to three-quarters of an inch; and some entirely, to an average depth of half an inch, with a rough coating, as if the bases of the tubercles had crowded together. The smaller pipes all exhibit some action of this kind, but generally to a less extent, as regards thickness, than the larger ones. In one case, however, a four-inch pipe was found covered to a thickness of about one inch. This was in that part of Myrtle Street which was formerly called Zone Street, where the entrance to a service-pipe was entirely stopped by rust. Wrought-iron pipes fill much more rapidly than cast-iron ones, and in several instances, service-pipes made of that metal, have, during the last year, become so obstructed as to be almost or quite useless.

The Jamaica Aqueduct pipe, which was originally ten inches in diameter, has been, in some cases reduced to eight by tubercles, which, however, are different in form from those in the Cochituate pipes. They appear to lap over each other in the direction of the current; this is very strikingly the case at the commencement of the pipe, as if their form was owing in some measure to the mechanical action of the current.

Knowing that this subject has occupied much of your attention, that you have consulted articles from various foreign journals that treat upon it, and that Prof. Horsford has it under consideration, no discussion upon the cause or causes of these tubercles will be attempted here. Further observations appear to be necessary, fully to develop these causes. It is very gratifying to know, however, that these tubercles may be removed by mechanical means, and at an expense much less than would at first be supposed. This has been fully proved at Cherbourg, where a most ingenious contrivance, described in the *Annales des Ponts et Chaussées for November and December*, 1851, was used by M. Gaudin, Engineer of the Cherbourg Water Works, to clean out

3,117 feet of 9 in. Pipe.
1,549 " " 7½ in. "
3,294 " " 7 in. "

which was done at a total cost of 7,853.18 francs, or an average of about 18½ cents a running foot. M. Gaudin thinks that the same apparatus might have

been used for a much greater length of pipe, and that the average cost of cleaning others with it would have been only about 11½ cents a foot.

In order to go through this process, the pipes were opened once in about every 180 feet, which it was thought might have been increased to 200 feet in many cases. The machine, which was attached to two cables, one of them being passed through the pipe by means of iron rods, was formed of metallic rasps attached to flexible arms, and so arranged that with one operation they would act upon the whole circumference of the pipe. By means of a sliding ring around the arms, and small cords, the rasps could be made to fit a larger or smaller diameter, which was necessary, in order that the machine might pass irregularities in the castings and particularly the joints, which sometimes had protuberances of lead upon them. It was pulled backwards and forwards by men who had hold of the cables, and who soon learned to tell when a new adjustment of the rasps was necessary, which was easily made by pulling one of the small cords. Its operation was so perfect, that the pipes were actually smoother after being cleaned than when first laid, as the projecting lead at the joints was removed. Whether the pipes, after being cleaned by this process, will fill up in a longer or shorter time than before, has not yet been ascertained.

Whenever tubercles in the Cochituate pipes have been removed, there has always been found under each isolated one a central spot of soft metal, easily cut with a knife, often a sixteenth of an inch deep, and from an eighth to a quarter of an inch across. Under the whole base of each tubercle, there appears to be a slight action upon the solid metal of the pipe, but nothing in comparison with that at the central portion. The Jamaica pipe, which has been laid about fifteen years, shows a much greater amount of action of this kind; but it does not appear to be confined to central spots, being more uniformly spread over the surface, as the oxidated coating itself is. A specimen of this pipe, taken from a point where it was scarcely an eighth of an inch thick, and where it burst, showed considerable action from a salt marsh on the outside, and also about the same amount from some cause within, both of which had reduced its specific gravity, as ascertained at Dr. Jackson's office, to 5.129, showing a loss of about 29 per cent of the original weight of the metal.

The City Engineer mentions also in this Report another matter of practical importance. He says: "After the great fire which destroyed Chickering's building, it was mentioned in some of the papers, and currently reported, that the hydrants had failed to supply water in as great a quantity and at as high a level as was expected. No one familiar with the laws of the flow of water through pipes could be at all surprised at such a result. This matter was understood, not only theoretically but practically, before the Boston Water Works were commenced, as will be seen by the following statement from the

first report of the Commissioners appointed for inquiry into the state of the large towns and populous districts in England, part 1st, page 316:—

'*Result of Experiments made on the 31st of January*, 1844, *to ascertain the Height that a Jet of Water will rise from the Mains and Services belonging to the Southwark Water Company, under a fixed pressure of* 120 *feet.*

'The first trial was made in Union Street, between High Street and Gravel Lane, Borough, over an extent of 800 yards of 7-inch main, and through the fire brigade stand-pipes, hose and jets.

'This 7-inch main is connected to the 9-inch main in High street, Borough, which, after a run of 500 yards, is joined to 200 yards of 12-inch main, and then continued by 550 yards of 15-inch main to the great main leading from the Company's works at Battersea, making a total distance of 5,500 yards from the place where the experiment is made.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 'One | 2½ | inch | stand-pipe, | with | 40 | feet | hose | and | 7-8 | inch jet, rose 50 feet. |
| Two | 2½ | " | " | " | 40 | " | " | 7-8 | " | " 45 " |
| Three | 2½ | " | " | " | 40 | " | " | 7-8 | " | " 40 " |
| Four | 2½ | " | " | " | 40 | " | " | 7-8 | " | " 35 " |
| Five | 2½ | " | " | " | 40 | " | " | 7-8 | " | " 30 " |
| Six | 2½ | " | " | " | 40 | " | " | 7-8 | " | " 27 " |

'Then all the fire-plugs on the main were closed except the first, and one 2½ inch stand-pipe, with 160 feet of hose, and a 7-8-inch jet, rose 40 feet.

'The second trial was in Tooley Street, off a 9-inch main, 1,400 yards in length, connected to 1,000 yards of 15-inch, and 6,650 yards from the works.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 'One | 2½ | inch | stand-pipe, | 40 | feet | hose, | 7-8 | inch jet, rose 60 feet. |
| Two | 2½ | " | " | 40 | " | 7-8 | " | difference not perceptible. |
| Four | 2½ | " | " | 40 | " | 7-8 | " | rose 45 feet. |
| Six | 2½ | " | " | 40 | " | 7-8 | " | " 40 " |

'Four-inch service in Tooley Street, 200 yards long, supplied through 200 yards of 5-inch pipe, from 9-inch main; one 2½-inch stand-pipe, fixed on the 4-inch service near the 5-inch pipe, with 40 feet of hose 7-8-inch jet, rose 40 feet; two 2½-inch stand-pipes, 7-8-inch jet, rose 31 feet.

'One 2½-inch stand-pipe fixed at end of service.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| '200 yards from 5-inch pipe, | | | 40 | feet | of | hose, | 7-8-inch | jet, rose 34 feet. |
| The | 2½ | inch | stand-pipe, | 40 | " | 7-8 | " | " 23 " |

'Seventy years ago, Dubuat's experiments showed how greatly the lengthening of a small pipe would diminish the force, and consequently the amount of discharge through it. An ordinary fire hose may be considered the same as a small pipe, and as all but one or two hydrants are necessarily several hundred feet from any single building, the loss of velocity experienced by the water passing through the hose must be considerable. The Chief Engineer says that he can throw from the Hydrants alone, without any engine, a stream over any private dwelling on Harrison Avenue; but this cannot be done in higher parts of the City and on

higher buildings, nor could it ever have reasonably been expected. The very tall buildings recently erected in comparatively low parts of the city can never have their highest stories protected from fire, by the simple pressure of the Cochituate water through hose: it must be forced up by means of engines.'"

In the same Report, under the head of "Stopcocks," the Engineer says: "A very important change was made, by removing the five large stopcocks on Tremont Street, from near the Roxbury line to the line of Chester Street, at Chickering's Factory, where, after having been thoroughly repaired and fitted with bevel gear, they were placed horizontally and enclosed in a substantial stone chamber. The necessity and importance of this change proved to be greater than was at first supposed; as two of the stopcocks, when taken out, were entirely unfit for service, and two others could not have been used twice more, in consequence of the composition facings of the valves getting loose. Their original location was such, that the settling and vibration of that part of the Tremont Road caused them to get out of repair quite often, and there is every reason to believe, that without the change made, they would have given serious trouble the present winter."

## 1853.

On January 11th, 1853, the City Council passed an Order authorizing the Cochituate Water Board to assess Water rates on all the Public Buildings: previous to the passage of this order, they had been supplied free.

January 26th, the waste of water being on the increase, the Water Registrar was directed, and given full power to commence an examination of the places and causes of waste throughout the City, and to employ persons for that purpose. This order was immediately carried into effect, and a large number of persons were fined. The Board, however, did not consider that the fine was sufficient to prevent waste, and therefore sent a communication to the City Council, recommending that they take measures to make the waste of water a penal offence. This communication was referred to the Committee on Water, who reported that it was inexpedient, as it would be very annoying to consumers to be arraigned before the Police Court for the delinquency of their servants.

Complaints having been made that water was shut off from the mains without giving notice, it was voted that the President be requested to give public notice, that the Board do not consider the City liable for any damages that may be occasioned by shutting off water at any time and without notice; but that notice will be given as heretofore, whenever practicable.

The Annual election of the Water Board took place April 25th, 1853, when the following persons were chosen:

Thomas Wetmore, Henry B. Rogers,
John H. Wilkins, Adam W. Thaxter, Jr.,
Jonathan Preston, Sampson Reed,
Thomas Sprague.

On the 27th, they met for organization, when Thomas Wetmore was elected President, and Samuel Holbrook, Clerk.

During this year, no action of importance took place; several changes in the Ordinance were made. The most important change was the discontinuing the use of hand hose in stables.

October 10th, 1853, J. Avery Richards was elected Water Registrar by the City Council. The new stable was built in the Pipe-yard, on Federal Street.

An offer of $28,000 was made by Eliphalet Baker, for the purchase of the Jamaica Pond Aqueduct property, which was referred to the City Council, who passed an order giving the Board full power, whereupon they voted that it was inexpedient to accept the offer of Mr. Baker.

To the Annual Report for this year, 1853, is annexed another Communication from Professor Horsford on the subject of the Accretions on the Iron pipes. He gives no opinion, as his investigations were not concluded; but his letter contains a great deal of information on the subject. See p. 162.

## 1854.

During the month of January, 1854, the waste of water increased to such an extent, that night, as well as day Inspectors were appointed; and the citizens were notified that in all cases where waste was discovered, the water would be immediately shut off; and, on February 1st, the Water Registrar was directed to publish, from day to day, the number of places of waste reported, with the statement that they would be shut off as fast as the men employed could do it.

February 1st, the City Engineer was instructed to report to the Board, upon the expediency of uniting the two main water pipes for the general supply of the City; the height of flow which may be relied upon, should such a connection be formed; and the line of district above such point of union, which would require to be supplied by artificial means. Also, the cost of disconnecting this service from the other parts of the City distribution, and the probable expense of necessary apparatus for raising a sufficient amount of

water to keep a uniform supply at the maximum height; the cost of laying another main from Brookline Reservoir, specifying the cost of a 36-inch and of a 30-inch main; and the practicability of supplying meters to each water taker, with the cost of the same.

The Report of the Engineer on these subjects cannot be found, and it is doubtful if he made one, as the water in the lake rose very rapidly after this vote was passed.

The annual election of the Water Board occurred on March 27th, 1854, when the following persons were chosen.

| | |
|---|---|
| Thomas Wetmore, | John H. Wilkins, |
| Henry B. Rogers, | Thomas Sprague, |
| Adam W. Thaxter, Jr., | William Washburn, |

Samuel Hatch.

And, on April 26th, they met for organization, when Thomas Wetmore was re-elected President, and Samuel Holbrook, Clerk.

During the month of April, the Ordinance providing for the assessment of the water rates on the Public Buildings was repealed, and an Order was passed that non-residents supplied with Cochituate water, should be charged the regular rates, and also a proper proportion of the whole annual cost of interest and expenses incurred by the City for the works.

May 24th, Eliphalet Baker made an offer of $27,500 for the Jamaica Pond Aqueduct property, which was refused; and, on the 31st, he offered $30,000, which was also refused.

The trial of the case of Whipple vs. City of Boston, for damages for diverting the water of Lake Cochituate from Concord river, took place in the month of June. As this was the test trial for several claims made, it was one of great interest to the City.

The Water Board, in their annual Report, in speaking of these claims, says: "The Water Board have at last the pleasure of being able to state that the only outstanding claims for damages, occasioned by the original construction of the Water Works, have been finally settled by the adjustment which has been effected during the past year, of those made by the mill owners on Concord river, and by the Middlesex Canal Corporation, for being deprived of the water of Lake Cochituate. These claims were originally ten in number, and the aggregate amount of damages sued for was nearly half a million of dollars.

Two of these claim suits were tried; in one, the jury could not agree on a verdict; and, in the other, when the damage claimed was $150,000, they

awarded $500. A proposition was then made for the discharge of all the claims, and they were finally settled, and the suits discontinued, by the payment of the sum of $6,678.90, on the part of the City.

October 11th, it was ordered, that, Mr. Edward F. Knowlton, the Superintendent of Brookline Reservoir, be also Superintendent of Charles River pipe chambers, and of Lake Cochituate, and perform all the duties required in those offices, by the rules and regulations of this Board. And, also, that he have the care and management of all the lands belonging to the city in Saxonville, and in the neighborhood of the Lake and Aqueduct, and not connected with the Water Works. And that there be paid to said Knowlton a compensation at the rate of $1,200 a year, in full for all said duties and services; and that he be also allowed the use of the house and land recently occupied by the late Superintendent of the Lake, Mr. Vannevar, rent free.

The said Knowlton to pay, at his own cost, all his own travelling and other expenses, and postages, required in the performance of his several duties.

On November 15th, Mr. John H. Wilkins sent in his resignation, as a member of the Board, to the City Council, which was accepted, and Charles Stoddard was elected to fill the vacancy.

During the same month of November, on the 22d, the Board took possession of a certain strip of land in Osborn Place, belonging to Francis Richards and others, for the purpose of supplying the premises of the Model Lodging House Association with water. (See page 275, Water Board Records.)

In October of this year, there was a sensible deterioration in the quality of the water, which was a source of much annoyance. It "consisted of a marked and peculiar taste, resembling, in the opinion of some, that of fish, but to a great majority of persons, that of cucumbers or some similar vegetable, the taste being sometimes accompanied by a disagreeable smell."

As this taste continued, and the Board were unable to ascertain the cause of the trouble, they employed Messrs. E. N. Horsford and Charles T. Jackson to investigate and Report, which they did in December following. (See annual Report, 1854, pages 32 to 59.) Dr. Jackson closes his communication thus: "In conclusion, I would assure you and the citizens of Boston, that there is good reason to believe that the unpleasant taste of Cochituate water is rapidly passing away, from operations naturally taking place in the lake, and that the water will probably soon be as good as ever.

"I regret, as much as any one, that we have not been able to settle all the interesting questions that have arisen, as to the origin of the impurity complained of. Thus much we have done; we have proved that the peculiar taste of the water does not originate within the pipes, but exists at the fountain

head, and that it is not the result of animal putrefaction, but of vegetable fermentation, and that there is nothing deleterious in the water. These are some points gained. In time, we may search out the other matters, should the evil ever again recur." (City Documents on the subject of Water, for year 1852, Nos. 6, 24, 51, 67; 1853, Nos. 7, 20, 74; 1854, Nos. 11, 16, 19, 25, 82, 111; 1855, Nos. 9, 30, 43, 48.)

# CHAPTER XVIII.

## 1855 TO 1858.

Sale of Land at the Brookline Reservoir — Petition for abatement of Rates by the Boston Sugar Refinery Co. — Resignation of the Water Registrar — Election of his successor — Attempt to abolish the Water Board — Resignation of Albert Stanwood, and the appointment of his successor — Resignation of E. S. Chesbrough, and the appointment of his successor — Resignation of Henry B. Rogers — Extract on the bad taste of the water, from the Annual Report — Election of Water Board for 1855-6 — Their Organization — The expediency of making the water free, and of insuring buildings, discussed — Re-election of Albert Stanwood and his acceptance — Decision of the Supreme Court in regard to Taxes — Application from the Navy Yard for the water — Election of Water Board for 1856 — Their organization — First appointment of Standing Committees — Sale of the Jamaica Pond Aqueduct — Erection of a new Dam at the Lake — Construction; Cause of its erection — Waste of Water — Act passed to raise the Dam at the Lake two feet, but not accepted — Water Board elected for 1857, and their organization — Election of Superintendent — Third pipe laid over Charles River Valley — Report on laying the third Main — Management of Water Works in other cities — Election of Superintendent of Charles River Pipe Chamber — Notice of application for an act to raise the Dam of the Lake.

THE only action of importance by the Board during the months of January, February and March, was the sale of a lot of land situated westerly of the Brookline Reservoir, containing about 78,300 square feet. This sale was made subject to the following restrictions:—1st, That the City should have the right at all times to enter upon said land for the purpose of altering or repairing the Aqueduct or Tunnel within the same, without being liable for trespass or damages.

2d. That no building of any kind should ever be placed upon the same.

3d. That the land should be kept in good order, and cultivated as a garden or farm, or laid out in grass and trees.

The Boston Sugar Refinery Co. made an application in the month of January, for an abatement of the water rates, on which subject several hearings

were had; and, on the 20th of March, they had leave to withdraw. Not being satisfied, they asked for another hearing, which was granted; at the meeting appointed for this purpose, they appeared by their counsel, Peleg W. Chandler, Esq., and the Board voted on the same day, that the Water Registrar be directed to charge for the first 6000 cubic feet per day, at the rate of two cents the hundred gallons, and the balance at one cent the hundred gallons, on condition that the company furnish and attach a meter at their own expense, of such pattern as should be approved by the Water Registrar.

On April 2d, J. Avery Richards sent to the City Council his resignation as Water Registrar, which was accepted, and William F. Davis was appointed to fill the office until an election took place. Several trials were made to elect a person to fill the vacancy; the Board of Aldermen and Council could not agree, and it was not until October 29th, that both Boards concurred in the election of Mr. Davis.

During this year, no Water Board was elected, and the old Board held over.

The cause of this was a movement on the part of the City Council to abolish the Board altogether, as they believed that the works could be managed much more economically by the appointment of a Superintendent of the Water Department, with such assistance as he might require. This subject was referred to the Committee on Water, who reported in favor of it, when it passed one branch of the City Council, and was finally defeated in the other.

The Supreme Court decided this year that all the lands and property taken under the Water Act, or purchased for the purpose of carrying out the Act, and which were necessary and proper for the purpose, were exempt from liability to taxation.

On account of a change made in the management of the Water Works, Mr. Albert Stanwood sent in his resignation as Superintendent of Iron Pipes and the Pipe-yard, on August 20th, which was accepted; but, on the 31st, it was reconsidered, and laid on the table; and, on October 23d, it was taken up and accepted; and, on the 30th, Isaiah Wadleigh was elected to fill his place.

October 1st, Mr. E. S. Chesbrough, the City Engineer, sent in his resignation, which was accepted, and James Slade was elected to fill the vacancy. On the 22d, Mr. Henry B. Rogers sent in his resignation as a member of the Board.

In their Annual Report for the year 1855, in speaking of the subject of the bad taste of the water, which caused so much anxiety in the latter part of the year 1854, the Board say: "There has been no complaint of any offensive change in the *character of the water* during the year, similar to that of the previous one. The impurities of that year, so obvious both to the taste and

smell, gradually disappeared, and were not perceived anywhere, about the middle of February, leaving their cause and origin in entire obscurity. We still believe that the most plausible suggestion was that made by the Water Board, and confirmed by the opinions and able researches of Drs. Horsford and Jackson, published with the report of last year, that the remote cause of the impurity was to be attributed to the long drought and heat of the summer of that year, and the unusually low state of the water in the Lake; and was the result of *vegetable* decomposition. If it be so, the evil was one which we must probably contend with again; and it becomes important that the water in different parts of the lake should be continually watched, particularly during the summer months, and the slightest deterioration traced, if possible, to its source."

## 1856.

On February 4th, 1856, the City Council elected—

Thomas Wetmore, Joseph Smith,
Charles Stoddard, Jonathan Preston,
John H. Wilkins, John T. Dingley,
Samuel Hatch,

a Water Board for the balance of the year 1855–56; and, on the 7th, they met for organization, when Thomas Wetmore was chosen President, and Samuel N. Dyer, Clerk; the latter, in place of Samuel Holbrook.

On the 11th of February, a Committee was chosen on the part of the City Council, to consider the expediency of making the *water free*, and paying the interest on the water debt by *insuring the buildings that were supplied*; and on June 30th, they reported that it was inexpedient to take any action thereon.

Mr. Albert Stanwood was again chosen Superintendent of the Pipe Yard, Iron Pipes, Aqueduct and Reservoirs; which office he accepted on the 21st of February.

Mr. Wetmore, finding his health would not permit him to continue as a member of the Board, sent in his resignation April 7th, which was accepted. Mr. Wetmore died at the age of sixty-six years, seven months, March 30th, 1860, about four years after his resignation.

On April 17th, an application was made for the use of the Cochituate water at the Navy Yard, in Charlestown, which was referred to the City Council, who passed an order giving the Board full power to act in the premises as they considered for the interest of the city.

The annual election of the Water Board, for the year 1856–57, occurred on May 5th, when the following persons were chosen:

| | |
|---|---|
| John H. Wilkins, | Samuel Hatch, |
| Jonathan Preston, | Charles Stoddard, |
| John T. Dingley, | Thomas P. Rich, |

Tisdale Drake.

They met for organization on the 13th, when John H. Wilkins was chosen President, and Samuel N. Dyer, Clerk: STANDING COMMITTEES of the Board were also appointed, for the first time, to have charge of the Eastern and Western Divisions, and of the Water Registrar's Department.

It having been decided that it was best to make sale of the property known as the Jamaica Pond Aqueduct, with the condition that no water should be supplied within the present limits of the City of Boston, from these works, the President was authorized to advertise for proposals for the same.

The reason for coming to this conclusion was, that all the objects for which the purchase was originally made, had been or would be accomplished; these objects were, 1st, To be rid of rival works; 2d, To quiet all claims for injury to their pipes, by laying down our pipes; 3d, To annul the privilege of breaking up and injuring the streets, whenever and wherever they saw fit. In answer to the advertisement, Messrs. George H. and T. B. Williams, of Roxbury, had several interviews with the President, which resulted in their purchasing the property, November 1st, for the sum of $32,000.

The Legislature of 1859, having changed the boundary line between the cities of Boston and Roxbury, thereby adding two hundred and four acres of the territory of Roxbury to that of Boston, as the agreement was confined to the lines then existing, that company had the right to supply this territory in common with the Cochituate Water Works. A communication was received from them, July 12th, 1859, suggesting a settlement; but it was considered that no action was necessary.

A communication was received, August 26th, 1856, from the City Engineer, recommending the immediate construction of a new dam below the present one. This communication was referred to a Committee to consider and report, which they did September 18th, when it was voted to erect the dam, according to a plan proposed by Mr. Knowlton.

The erection of this dam was commenced on the 20th day of October, but was not completed until the following year. The point chosen for this erection, was 460 feet below the present one, because the bottom at this point was principally of gravel; a row of piling eight inches thick was driven to depths of from fifteen to twenty feet for a foundation; they were tongued

and grooved, each pile being ringed; and great care was taken to keep the joints close, as all above was constructed of heavy stone masonry.

The cause for the erection of this dam was, that the one originally built showed signs of weakness, as it was built on a bed of quicksand. Whenever the lake was full, or nearly so, a great many springs boiled up through it, outside of the dam; some of them, within thirty or forty feet of it, others at a distance of one and two hundred feet. These springs, or a part of them, were continually bringing out small quantities of sand, and to such an extent that it was deemed unsafe to keep the lake full, unless back water could be kept on the dam. This accordingly was done by temporary means, until the new dam was constructed.

The waste of water increased to such an extent in the month of December, that the Board passed an Order, on the 17th, requesting the citizens, through the papers, to use every means in their power to prevent the same; they also requested the Mayor to order the police to report to the Water Registrar all cases of waste, either by night or day, that could be discovered.

Application was made to the Legislature for an Act to raise the dam at the Lake two feet. The act passed; but on account of a proviso that gave the towns on the margin of the lake power to tax the lands taken for this purpose, it was not accepted by the City.

## 1857.

The Annual Election of the Cochituate Water Board took place on February 9th, 1857, when

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|---|---|
| John H. Wilkins, | Thomas P. Rich, |
| Samuel Hatch, | Tisdale Drake, |
| Charles Stoddard, | Ebenezer Johnson, |
| Samuel Hall, | |

were elected, and they met for organization on the 13th, when John H. Wilkins was re-elected President, and S. N. Dyer re-chosen Clerk; and Messrs. Stanwood and Knowlton were re-elected Superintendents of their respective departments.

May 7th, it was voted to lay the third pipe, of 36-inch diameter, across the Charles River Valley from the west to the east pipe chamber; the two originally laid were 30-inch diameter. The work of laying this pipe was commenced early in July, and was completed, and the water let through, on the 9th of September; the length of pipe was 985 feet, and was contracted for at $51 per gross ton.

The good effect of laying this pipe was at once visible in the increased height of the water in all the Reservoirs.

The Board of Aldermen passed the following Resolve on May 25th:

*Resolved*, That in the opinion of the City Council the time has arrived for the City to lay a third main from the Brookline Reservoir into the City, and to that effect it is Ordered: That the Water Board furnish to the City Council an estimate of the cost of the same.

The Common Council, on June 2d, referred the whole subject to the Committee on Water, who reported on the 29th, recommending that the whole subject be referred to the Cochituate Water Board for their views, recommendations, and also estimates of cost; and, August 18th, the Board made their Report. (City Document, No. 50, 1857.) In this Report, they review the subject at length. They commence by giving a general outline of the works, and calculations of the Commissioners as to the quantity of water required, the population, and the supply, and then say: "With nine years' experience, it is not a little interesting to look back and notice the difference between the anticipation of the Commissioners and the actual results."

They then state that the population has increased very nearly in the anticipated ratio, but that the consumption has been far beyond all calculations; that their estimates of the capacity of the Lake have been fully realized, and that if means be adopted to store the water which now runs to waste, nearly double the estimated supply can be obtained.

After speaking of the enormous consumption of water, they say: "They regard the acquisition of an additional supply of water at the Lake as a *sine qua non*." Also, that if an Act cannot be obtained allowing the Lake to be raised, then some other means must be resorted to; either connecting some other supply, or separating the East Boston supply, and obtaining it from some other source, or a greater economy in the use of the water. There is one way, and only one, that is obvious, by which consumption can be diminished, viz: by the introduction and general use of meters.

"If every water-taker should be obliged to receive and pay for the water, by measure, there can be no question that the consumption would be immensely diminished—so also would be the receipts. The question with most takers would not be, how much water can I use with convenience and comfort, but, how little can I get along with?" They do not, however, recommend the universal use of meters; in fact, they state several objections to their general application, principally however, as to expense, and as a sanitary measure.

Attached to the Report are the estimates, in detail, of the City Engineer; for a 36-inch pipe, he estimates $425,150, and for a 40-inch pipe, $499,400.

After this Report was received, there was considerable discussion in the City Council upon the subject, and it was finally referred to the next City Government.

July 9th, the Board being desirous of obtaining all the information possible in regard to the management of water works in other cities, sent a Committee of their number, consisting of Messrs. Stoddard and Drake, to Albany, New York, and Philadelphia, to gain such information, and to report, which they did on November 7th. In their Report, in speaking of the management of the various water works, they say, of those in Albany:

"The service-pipes in Albany are but four and a half feet below the surface of the ground, without boxing, or other precautions to keep them from freezing. They are inserted in the main at the expense of the water takers, and are at their own risk, as are the pipes within their own premises, no city officer having any supervision over their insertion.

Plumbers, by whom this work is done, are licensed and held in bonds to the city for the faithful performance of their duties. These duties, to which these bonds apply, relate to introducing water from the mains, and *not* to fixtures within the buildings.

Hydrants are allowed in courts and yards, for the use of tenants near them. Water takers are not restricted to the use of any particular kind of fixtures.

Whenever waste is suspected, the Superintendent visits and examines the premises in person, or sends some one else to do it. In some instances, notice of such visit is given. There is no extra force employed to detect waste; but the men, when not otherwise engaged, are employed in this business.

Steam engines pay by the horse power, hotels, by the number of rooms, steamboats, three dollars a day during the running season.

The Fire Department contributes nothing to the expenses of the Water Works. The use of hand hose is allowed at all hours of the day.

All vacant lots on the streets through which the pipes are laid, are taxed for the water, whether used or not, it being considered as enhancing the value of the land. The tax is less than on lots on which buildings are erected.

Meters have not been used, as yet, in Albany. They are regarded as important for hotels, and other places where large quantities of water are used.

Of the Croton Water Works in New York, they say: — "The mains in New York are tapped under the supervision of the Water Board; but all service-pipes are attached to the tap and carried into the houses at the

expense of the owners or tenants, and at their own risk. All plumbers who do this work are licensed, and give bonds to the city, in the sum of three thousand dollars, for the faithful performance of their duties. They are employed by the water takers to conduct the water from the mains into the houses; and it is to *this work* their bonds apply, and not to pipe work in the houses.

"The plumbers make weekly returns of their doings to the Water Board. Hydrants are allowed in yards and courts. Water takers are not restricted as to their fixtures.

"A special police of twelve persons is employed by the Board to examine and report all places where waste is supposed to exist. They also distribute notices, bills, etc., and make daily reports to the Board. When water is cut off for waste, a fine of ten dollars is required to be paid before it is let on again.

"The Water Board expressed the conviction that the greatest waste was in the private dwellings of the rich; the water, in many of them, running to waste all the time. They find great difficulty in detecting waste, and they have not yet been able to devise any effectual measures to prevent it.

"They think that meters, for private dwellings, are not yet practicable, because of the great cost of the number required to supply all houses, to which must be added the expense of looking after and keeping them in repair.

"Water for shipping is let out at a yearly rate of $9,000.

"Hand hose may be used before eight o'clock in the morning.

"All houses and buildings are charged for water, whether they take it or not. Vacant lots are not charged. All charges for water become a lien upon the property.

"Interest, at the rate of twelve per cent per annum, is charged on all arrears for water, from the time the bills are due until paid. If not paid within four years, the property is sold to pay the dues; but property thus sold may be redeemed within two years of the sale."

Of Fairmount Water Works, in Philadelphia, they say: "In Philadelphia, the executive officers of the Water Department manifested a readiness to give all information we asked, and put themselves to much trouble to explain their method of keeping the water accounts.

"Many of their replies to our queries were similar to those given in New York, and need not be repeated. Meters have not been used. All the water used in Philadelphia is pumped, either by steam or water power. They have in use, for this purpose, nine water wheels and eight steam engines.

"It was the deliberate judgment of the Water Board and officers, both in

New York and Philadelphia, that as much water was wilfully wasted as was used."

They "saw in Philadelphia, a portable steam boiler, constructed at small cost, for thawing out frozen Hydrants. The mode in Boston has been to *borrow buckets of hot water* from the neighboring houses, much to their annoyance, and with great loss of time."

They closed their Report by recommending several changes in the management of the works, of which the following have been adopted by the Board, viz: the discontinuance of the use of outside Hydrants and Taps, for water-takers, and the collection of meter accounts quarterly.

On July 23d, Mr. Allison S. Kempley was chosen Superintendent of the Pipe Chambers at Charles River, in place of Mr. Oliver Morse, resigned.

November 23d, it was voted to give public notice of the intention of the Board to apply to the Legislature for authority to raise the dam of the lake two feet. This met with the same opposition from the several towns as the previous application, and the Act obtained was similar to the previous one, and was not accepted. (City Document on the subject of Water, for year 1856, No. 11; 1857, Nos. 12, 50; 1858, Nos. 7, 18, 24, 57, 60.)

# CHAPTER XIX.

## 1858–1861.

Election of Water Board for 1858 — Organization of the Board — Agreement with the several Towns in regard to raising the Lake — Natick road raised — New Pipe on Dover Street Bridge — Drinking Fonts in the Streets — Order passed to lay a new Main from the Brookline Reservoir — Size of the Main — Proposals and Contract for the Pipe — Raising the Dam at the Lake — Application to the Legislature for leave to lay new Main — Location of the new Main — Purchase of the first Worthington Meters — Petition for the use of the Water for a Skating Park — Discussion on the Subject, and refusal to grant the Request — Important Events in 1859 — Election of Water Board for 1859-60, and their Organization — Breach in the Aqueduct — Raising of the Lake — New 40-inch Main — Claims of the Meadow Owners on Sudbury River — Offer to sell Farm Pond to the City — Difficulty with the Hotel Keepers in regard to charging them by the Meter — Use of the Water for Skating Parks — Water for a Fountain — Election of Water Board for 1860-61, and their Organization — Stone Bounds ordered to be put down at the Lake — Report on the new Main — Resignation of John H. Wilkins — Election of his Successor — Resolution passed by the Board — Mr. Johnson elected President of the Board — Water to supply Cistern in Charlestown — Change of Pipe on Tremont Street, between Waltham and Dover streets.

On the 18th of January, 1858, the City Council elected

John H. Wilkins, Samuel Hatch,
Benjamin James, Ebenezer Johnson,
Tisdale Drake, Thomas P. Rich,
Samuel Hall,

a Cochituate Water Board for the year 1858–9. Mr. Hall, however, was not elected until February 8th, the two branches of the City Council being unable to agree. February 5th, the Board met for organization, when Mr. Wilkins was re-chosen President, and S. N. Dyer, Clerk; at the same time, Messrs. Stanwood and Knowlton were re-elected Superintendents of the Eastern and Western Divisions respectively.

April 8th, a Committee was chosen to confer with Committees from the

towns of Framingham, Natick and Wayland, to see what arrangement could be made with them, so that they would join the City in an application for an act to enable the City to raise the dam at the lake two feet; several interviews were had, and it was finally agreed that if the City would pay

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| to the town of | Framingham | the sum of | . . . . . | $4,500 |
| " " | Natick | " " | . . . . . | 3,000 |
| " " | Wayland | " " | . . . . . | 1,000 |

that the said towns would make no opposition before the Legislature. This proposition was submitted to and accepted by the Board, the amount to be paid after the act should be passed and accepted by the several towns and the City. As the Legislature did not meet until January 1859, no further action was taken this year, except to give notice of the intention to apply for an act, which was done September 16th.

May 6th, Mr. Knowlton was instructed to raise the road in Natick that passes through the lake, to the heights given by the City Engineer, about three feet, so that it would be perfectly safe when the lake should be raised.

It having been decided to rebuild the Dover Street Bridge, it was voted, June 3d, that in order to keep up the supply to South Boston, a temporary 20-inch pipe be laid over the bridge, and the present supply be continued until this pipe was ready to be connected at both ends; after this was done, the old pipe was to be removed laterally, so as to come under the southerly sidewalk, the bridge being widened; but, upon further investigation, it was decided to lay a new pipe in its proper position, and not to draw off the water from the old until the new was ready to be connected at both ends, and then to take up the old pipes. Those that were taken up were considerably corroded. On examination, it was found that those that were the least corroded, had, in casting, been covered with the sand used in the moulds, which had, in part at least, become vitrified and burned into the metal of the pipes; it would therefore seem that this was the cause of their non-corrosion.

Most of the new pipes that were laid are Scotch pipes, coated with Dr. Smith's patent preparation, which was found in other places to answer an excellent purpose. These pipes were used in this position to test the value of an internal coating in preserving the pipes, as all the water used in South Boston must pass through them. Man-holes were placed in this pipe for the purpose of examination. This pipe was opened in March, 1866, nearly eight years afterward, and found to be in as good condition as when first laid.

During the month of June, several petitions were sent to the City Council, asking that Drinking Hydrants might be placed in the public streets, which were referred to the Committee on Water, who thoroughly investigated the

subject, and reported, October 25th, that the petitioners have leave to withdraw; which report was accepted.

July 30th, the City Council passed the following Orders:

*Ordered*, That the Cochituate Water Board be, and they are hereby authorized to lay a new main from the Brookline Reservoir to the City, the main to be of such dimensions, and laid on such route, as the Water Board may deem expedient.

*Ordered*, That the treasurer be authorized to borrow, under the direction of the Committee on Finance, a sum not exceeding four hundred thousand dollars to defray the expense of laying a new main as above authorized.

The Board, after the receipt of the above order, had several interviews with the City Engineer, and on July 8th, decided that the main should be forty inches in diameter, and that it should be connected with that in the Brookline Gate House by an extra pipe, equal to the difference between the new and the old 36-inch one, whenever found necessary or desirable. This was done, as it was not considered safe to cut through the bulkhead, and insert a larger pipe; this extra connection was a 20-inch branch, which is now capped over.

On the same day, it was decided to advertise for proposals for the pipes; and when the proposals received were opened, the offer of J. W. & J. F. Starr, of Camden, N. J., was accepted, for twenty thousand feet, at the rate of thirty-three dollars per gross ton. It was voted that they be required to give bonds to the amount of twenty thousand dollars, with two good sureties, for the fulfilment of the contract.

August 26th, Mr. Knowlton was directed to raise the Dam at the Lake, so that it would be ready to use as soon as the Act was passed.

Application was made to the Legislature for leave to lay pipes through the public streets and over private lands in the city of Roxbury, town of Brookline, and the city of Boston.

December 6th, it was voted to lay the new Main on the same route as the others, as far as Dover Street.

The first Worthington meters were purchased December 24th, when an order was given for 50 one-inch, 12 five-eighths, and 1 two-inch meters. The Worthington meters had been on trial for some two years, and had proved satisfactory.

The Marlborough Reservoir was sold this year, July 29th, to Mr. Amory Maynard, for the sum of $8,000, two thousand cash, and the balance in five

years. Mr. Maynard was unable to pay the note at the expiration of the time, and the mortgage was finally sold.

In the latter part of November, several petitions were sent to the City Council, asking that the Cochituate water might be used for the purpose of flowing a Skating area upon the low portion of the Common, which were referred to the Board, who reported, December 1st, that it should not be considered for a moment, on account of the great hazard that would certainly attend the experiment, to the efficiency of the high service in the different parts of the City, and especially to that on Beacon Hill; and also, on account of the danger that would result from a probable deficiency of water in case of fire. The Board of Aldermen, however, were not satisfied with this Report, and referred it to the Joint Committee on Water, and the Committee on the Common and Squares, to confer with the Board and report, which they did. The Board were unable to convince them of the danger, and they made their Report in favor of granting the request, and offered an order directing the Water Board to furnish water as proposed, to the extent, at least, of one million gallons per day.

This order passed the board of Aldermen, and was sent to the Council for concurrence. The Board, believing it to be their emphatic duty, if possible, to put a stop to this appropriation of the water, sent a Communication to the City Council, (City Document No. 57, for 1858,) in which, after stating what had taken place, they say: — "In this position of the order, this Board looks hopefully but confidently to the wisdom, discretion, and conservative sentiment of the lower branch of the City Council. It invokes the most careful examination of facts, and the most weighty consideration of consequences. The safety and convenience of a large population, comprising, as a class, our most wealthy and highly taxed citizens, may be deeply affected by the vote that may be given. And if the scheme be allowed to be consummated, who can foresee and measure the evils that may accrue?" The communication then gives a statement of the heights of water in the Beacon Hill Reservoir at different dates, showing the danger of allowing any extra use of the water, and then says: —

"The Order which has passed the Aldermen, directs the Water Board to furnish water 'not to exceed 1,000,000 gallons per day, unless a greater quantity may be necessary, and can be furnished without detriment to the public interest.' Up to the limit of 1,000,000 gallons per day, the order is mandatory upon this Board, let the consequence be what it may.

"Now five feet of water in the Reservoir is about equivalent to 1,000,000 gallons. Whenever the water falls five feet in the reservoir, 1,000,000

gallons have been expended, together with what has been introduced during the time of fall; but the Reservoir will be so near to the proposed aperture for the discharge of the water, that the current into the city will be greatly checked, and nearly the whole quantity will come from the Reservoir; and the draft of 1,000,000 gallons will reduce the water nearly five feet." "In the cold season of 1856–57, when the water was extremely low, or there was none at all in the Reservoir, there were forty-one days when the water was not over five feet deep; and, of course, had this Board been required to draw a million gallons for skating purposes on these days, there would have been that number of days added to the list when there was no water in the Reservoir, — making, in all, fifty.

"This Board is not unaware of the popular pressure for this measure, — a pressure which it is much more agreeable to yield to than resist. To account for this popularity it is well to consider that probably more than four-fifths, if not a much larger proportion, of the population of Boston live at an elevation above marsh level not exceeding sixty feet. Four-fifths of all the population are sure of a constant supply, and are in no danger of being affected by any amount of waste or consumption.

"Hence four men out of every five, and, indeed, probably a much larger proportion, being entirely and absolutely out of harm's way, may well be ready and urgent for the experiment."

They then state how careful the City Council had been as to whom they intrusted the care and management of the works from their first construction, and conclude their Report thus: "It has been a rare thing for an individual to be put upon the Board, who has not attained knowledge and standing in the community by repeated and acceptable performance of service in some branch or department of the City Government. The members of the present Board certainly have indulged the idea that they offered in their respective characters, acquired in the public service, a guaranty that their duties would be honestly and faithfully performed; and that they were selected to fill the Board, and have the large additional trust of supervising the laying of the new main to Brookline, precisely on account of their respective characters thus obtained.

"Allow this Board, therefore," they say, in conclusion, "to put in the most serious manner, the question, whether it is wise and whether it is expedient, under the stimulus, perhaps, of outside pressure, for the City Council now, for the first time, to step in and assume and exercise the power of controlling the use of the water in a particular case, — a power which in general is clearly reposed in this Board, and for no other apparent reason than because this

Board cannot, in the exercise of fidelity to its trusts, either propose or invite any compromise on the matter of a supply, where it believes that no supply can be given without hazard to the public interest; and, in this manner, and for the carrying of a particular point, to impair the discretion, control the judgment, and annihilate the just independence of this Board."

This communication had the desired effect, the Council refusing to concur.

## 1859.

The breach in the Aqueduct at Needham, the raising of the Dam at Lake Cochituate, the laying of the new Main, and the settling of the claims of Meadow owners on Sudbury River, make this the most eventful year since the completion of the works.

The annual election of the Water Board took place on February 28th, when the following persons were chosen: —

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| John H. Wilkins, | Ebenezer Johnson, |
| Ebenezer Atkins, | Samuel Hall, |
| Tisdale Drake, | John S. Dingley, |

George F. Trench.

They met for organization March 2d; at which meeting, John H. Wilkins was again chosen President, S. N. Dyer, Clerk, and Messrs. Stanwood and Knowlton re-elected Superintendents.

### Breach in the Aqueduct in Needham.

This breach occurred on the 29th of March, an account of which is given in the annual Report of the Board, and of the City Engineer, from which we make the following extract:

"The Aqueduct, at its connection with the pipes crossing Charles River, on the westerly side in Needham, gave way early in the morning, and the great volume of water, which was passing through the same, in a very short time produced the most destructive havoc upon the premises, — carrying pipes, gravel, brick and stone masonry and other materials away, and precipitating them into Charles River, choking up its current, and causing it to overflow its banks and throw back water upon the meadows and hills above.

"The sight of this devastating outbreak was truly appalling.

"A young man, son of Mr. Reuben Ware, living near at hand, had the presence of mind to mount and ride with all speed to the lake to appraise Mr. Knowlton of the breach, and the water was instantly turned off; so that, in probably two hours from its occurrence, the water ceased to flow injuriously at the breach.

"This prompt and highly meritorious act of young Mr. Ware, by which further incalculable injury was seasonably prevented, was deemed worthy of special notice by this Board, and he was presented by them with a valuable watch and chain.

"By this untoward occurrence, the stone gate-house and nearly one hundred feet of the brick conduit were carried away, and, with several of the connecting pipes, were precipitated into the river to the distance of from seventy-five to one hundred and fifty feet. What was the cause of this occurrence is only matter of conjecture, as all the traces of weakness and of failure were entirely obliterated in the accompanying ruin."

The City Engineer, however, says: "From the appearance of such of the broken pipes as could be found after the accident, there can be no doubt that it was first caused by a slight leak, probably a crack, in one of the pipes. A little water running down by the pipes would very soon wash down enough sand and gravel to undermine them, when, having nothing to support them, they must, of necessity, break; and, one of them once broken, such a torrent of water would flow from it as to wash out, in a short time, a very large hole in such material as the hill was composed of.

"As the hill was washed away, first went the pipes, then the pipe chamber, and, lastly, portions of the conduit, until the water was shut off at the lake.

"The surface of the ground being frozen, and the water from the leak following down by the side of the pipes, without showing on the surface, would be sufficient cause of the leak not having been discovered the previous afternoon, when the spot was passed over for inspection by Mr. Knowlton.

"Most probably the leak in the pipes did not commence until some time during the night.

"Instead of restoring the hill to its original shape, the new pipe chamber was set farther back in the hill, a distance of about ninety feet, and the hole filled up by puddling in the gravel and sand to a much flatter slope than formerly. This process of puddling in was chosen in preference to building up piers of masonry under the pipes, because, in this way, the pipes could be laid, and the water could be set running to the City again in much less time than it would have taken to build up brick or stone piers. The filling is now quite as firm and solid as the hill ever was previous to the break; and, because of the greater flatness of the slope, it is now much less likely to break away than formerly.

"The break occurred on Tuesday. On the next Thursday morning, the trench was filled in enough to receive the pipes. On the next Saturday night, at nine o'clock, one line of pipes was laid, and water passed through it to the

City. At six, P. M., on Sunday, the second line of pipes was connected, and water passed through it to the City; and, on the succeeding Thursday, at half past five, P. M., the third and last line of pipes was connected, and the water was flowing through all the lines of pipes. The whole time from the break to the full restoration of the pipes, conduit, and gate chamber, having been nine and one-half days.

"A very great amount of gravel and sand was washed into the river, and, for a short time, it was entirely dammed up, and had it not been for the presence of mind of some of the neighbors, who set themselves immediately at work to open a channel through it, it is probable that the river would have broken through the line of pipes laid in the valleys, or around the abutments of the bridge. In either case, the damage would have been vastly greater than it was, and would have taken a much longer time to repair.

"Messrs. Knowlton and Stanwood, Mr. Bird, the Chief Engineer of the Fire Department, and many persons, aided very efficiently in repairing the break.

"During the summer, a large force of men was employed, under the personal supervision of Mr. Knowlton, in cleaning out the river, so that no obstruction would be made to the flow of water to the mills, or by the accumulation of anchor ice during the present or any succeeding winter."

The whole expense occasioned by this breach was $15,380.83.

## The Raising of Lake Cochituate.

The third attempt to obtain an Act acceptable to the City was successful, as all the towns bordering on the Lake had been settled with, as mentioned in the previous chapter, and the following Act was passed without opposition, on the 5th of April, and was accepted by the City Council, May 6th.

### The Act.

Section 1. The City of Boston is hereby authorized, by and through the agency of the Cochituate Water Board therein, or by and through any other agency which shall be established therefor, by the City Council of said city, to raise the dam at the outlet of Lake Cochituate, formerly called "Long Pond"; lying in the towns of Natick, Wayland, and Framingham, to the height of ten feet above the floor of "Knight's Flume," so-called; and may also take and hold, from time to time, by purchase or otherwise, any lands or real estate on and around the margin of said lake, not exceeding five rods in width, measuring from the verge of said lake, when the same shall be raised to the level authorized by this act, so far as such lands and real estate may be necessary for the preservation and purity of said lake, for the purpose of furnishing a supply of pure water for said City of Boston; *provided, however*, that no lands or real estate

taken or purchased under this act, shall be exempted from taxation, by reason of such taking or purchase. All lands and real estate within said towns, heretofore taken or purchased, and now held by said city, by virtue of an act approved March thirtieth, eighteen hundred and forty-six, or by virtue of any other act heretofore passed, shall be and remain exempted from taxation so long as they continue to be so held and used for the purpose of said acts.

SECT. 2. The said City of Boston shall be liable to pay all damages that shall be sustained by any persons in their property, by the taking of any land or real estate, or by the flowage of the lands of any person as aforesaid; and in regard to such taking and flowing, and the ascertainment and payment of all such damages, the said City of Boston, and all persons claiming damages, shall have all the rights, immunities, and remedies, and be subject to all the duties, liabilities and obligations, which are provided in the one hundred and sixty-seventh chapter of the acts of the year one thousand eight hundred and forty-six, the one hundred and eighty-seventh chapter of the acts of the year one thousand eight hundred and forty-nine, and the three hundred and sixteenth chapter of the acts of the year one thousand eight hundred and fifty. Said City of Boston shall also indemnify said towns of Natick and Wayland against all injury which may at any time be done to any highway or bridge in such towns, by reason of the raising of the water, and maintaining the dam, as hereinbefore provided.

SECT. 3. This act shall not take effect until said City of Boston shall have paid to the said town of Framingham, the sum of forty-five hundred dollars; to the said town of Natick, the sum of three thousand dollars: and to the said town of Wayland the sum of one thousand dollars: nor until said act shall have been accepted by the City Council of the said City of Boston.

Much of the preliminary work was done the previous year; nearly all the roads had been raised, and many of the owners of lands to be flooded had been settled with.

May 2d, Mr. Knowlton was instructed to proceed to rebuild the gate-house, raise the sea-wall, and put the embankments in order, preparatory to raising the water two feet. On the 13th, it was voted to take down the gate-house at the Lake, and raise the floor to the height of four and one-half feet above the present one, and have the steps inside conform to the height raised; and to rebuild it with the same stone, and use the same windows, but to have iron doors, to swing the same as the present wooden ones, but not to have a door in the east end of the building. Mr. Knowlton was also instructed to contract for the stone for the wall, at a price not exceeding one dollar per running foot, delivered, the stone not to be less than four feet long, two feet high, and eighteen inches wide. This wall was raised three feet.

The total cost of raising the Lake, including the amount paid to the towns, was $27,130.

## The New Forty-Inch Main.

In the previous chapter, it was stated that authority was given to the Board to lay a new Main; also, that a contract was made for the iron pipe; but the work of laying the pipe was not commenced during that year. The work of laying the main from the Brookline Gate House was commenced in the latter part of March, 1859, and continued during the summer and fall, and it was connected with the 30-inch main crossing the Common, on the 24th day of December. Its continuation, to join the other main, at the corner of Tremont and Boylston streets, was postponed until the following spring.

The total number of pipes laid, and required to complete the work, was 1,947, or 23,364 feet; there were also 6 reducers, 13 man-holes, 2 drain pipes, 16 branches, 8 bonnets and 5 blow-offs. The total weight of metal was a little over 5,827 tons, or 13,052,480 pounds. The amount paid the Messrs. Starrs for the pipes, which includes freight, was $196,004.12. As the work required 20,000 feet more pipe than was at first contracted for, a second contract was made, with the same parties, for the balance that would be required, at the rate of thirty-seven dollars per ton; an advance of four dollars per ton. These pipes were all subjected to a test of three hundred pounds to a square inch, and they stood it remarkably well.

The Act passed by the Legislature, giving authority to lay the new main, was not accepted on account of the following proviso:

"*Provided all lands so taken and held, or that are now held by virtue of any former act, shall be liable to taxation.*"

"By accepting this act, the City of Boston would have laid itself at the mercy of the towns to tax a property which had cost more than $20,000: of course, such acceptance was not to be thought of."

It was originally intended by the City Engineer to bring the new main over the Mill-dam; the Board, however, on December 6th, 1858, voted to carry it by the old route, at the same time they petitioned for the above act to give power to carry it either way; and as the act as passed could not be accepted, they submitted the following questions to the City Solicitor:

1. May the City of Boston bring water from the Brookline Reservoir into the City by a new line of works, and take lands for that purpose, without the consent of the owners thereof?

2. May the City lay an additional water pipe along the line of the present works, for the purpose of bringing a larger supply of water from the Reservoir into the City?

Mr. Healey replied to the first in the negative, and to the second, in the affirmative.

After this decision was given, they again voted to lay the new main on the same route as the others. The City Council, on hearing this decision, passed the following order:

"Ordered, That the Cochituate Water Board be respectfully requested to furnish the City Council with a full and explicit explanation of the reasons why the route of the new main, now being laid from the Brookline Reservoir, has been changed from the route as generally understood by the Council when the appropriation was made, and as approved by the Mayor in his Inaugural Address;" to which they replied, on June 27th. (City Document No. 40, 1859.)

There was, however, such a general feeling as to the importance of laying this main entirely independent of the others, that measures were at once taken by the Board to see if they could purchase the right to lay the pipe over the Mill-dam; and it was finally agreed that the Mill-dam Corporation should give a warrantee deed authorizing the City to pass under their road for the sum of $20,000. But the City Solicitor at once discovered that they had no valid title, as the Corporation had already deeded all their interest to the Commonwealth, reserving only the franchise of using it, and taking toll thereon until May 1st, 1863, and the Mill-dam route was again abandoned, and the work commenced on the old line.

The public, however, were not satisfied with the decision, and it was so manifest that the popular sentiment was strongly in favor of this route, that new negotiations were commenced with the Mill-dam Corporation, and it was finally agreed that this Corporation should give a quitclaim deed, and the City paid for the same the sum of $12,500; and $500 was also paid to the Water Power Company for draining down the water so as to accommodate the laying of the pipes.

The right from the Commonwealth to maintain this pipe was not obtained until 1864, as will be seen by the record of that year.

July 5th, the Board voted to adopt the Mill-dam route, and directed Mr. Stanwood to take up the nine hundred feet of pipe that had been laid on the old line, and to commence immediately on the new one.

September 1st, Mr. George Griggs sent a communication to the Board, claiming the fee in part for the land taken for laying the pipe, but offered to settle, if his house could be supplied with water from the main. This was accepted on the part of the Board, but as they had no power to grant the use of the water, outside the limits of the City, it was referred to the City Council; and they declined to accept any such proposition, and the claim was afterwards settled by the payment of $1,000.

September 29th, it was voted to connect this main with the 30-inch pipe on the Common, and to continue the 40-inch to Boylston Street, and then connect with the other 30-inch; also, to put a 20-inch branch into the new main, to connect with Charles Street.

The beneficial effect of the introduction of this main was very soon felt, after its connection with the Beacon Hill Reservoir. The water in that Reservoir rose to an average of over six feet above its previous average.

East and South Boston were also particularly benefited by this additional head.

The total expense of laying this main was $304,657.07, or $14.07 per running foot, being $95,342.93 less than the original appropriation. The length of pipe laid was 23,174 feet, or a little over four miles.

### Claims of Meadow Owners on Sudbury River.

The proprietors of Sudbury Meadows, one hundred and fifty in number, memorialized the City of Boston for payment for damage done their property by letting down water from the Reservoir at unseasonable times. This was referred to the Board with full power; and after visiting the premises in Wayland, and hearing the parties, they made a Report to the City Council, (City Doc. No. 49, 1859), which contains a complete history of the meadows from 1793 to the present time. They close their Report thus: "Sympathizing, as the Board does, in the sufferings of the petitioners, and desirous, as it certainly is, to do all that is proper to relieve them in the premises, it becomes an important question, What should the City do, not acting under a sense of having done intentional and legal damage, but under an appreciation of the hardship of the case of these proprietors, and with a disposition to restore them to the enjoyment of their original and natural rights?

"Weighing, as best it could, all the circumstances of this case, this Board have come to the following conclusion, viz: The City of Boston will convey to some responsible agent or committee, authorized to act in behalf of the proprietors, by quitclaim deed, all the right, title, and interest which the City possesses in and to the Reservoir at Hopkinton, with its dam, gate-house and flume, to have and to hold, and lawfully manage and control the same as they please."

After this Report was made, a proposal was received, "signed by one hundred and thirty-six meadow owners, obligating themselves to forbear all claims for damages, on condition that the city would convey to Col. David Heard, of Wayland, the property of the city in and to the Hopkinton Reservoir, and other real and personal property appurtenant to, and connected there-

with. The Board accepted the proposition; and as all the owners had not signed the obligation, and there might arise some difficulty with some who had, it was deemed prudent to require a good and sufficient bond to secure the city from all claims of everybody interested, — those who had, as well as those who had not signed the release. Messrs. David Heard and his brother Horace executed a bond to that effect, in the sum of $10,000, for the consideration of two hundred dollars. Thus was terminated, with mutual satisfaction, a controversy which caused the Board much anxiety. Not that it is to be supposed that the damages done by the city were nearly so great as the sufferers thought them; nor that their grievances will end with this addition to their means of security; but because appearances were against us; and if in a single case, out of one hundred and fifty owners, a single one could establish even a small damage, the aggregate would be frightfully large."

During the year, Mr. H. M. Simpson, the owner, offered to sell to the city his right to the waters of Farm Pond, but no action was taken thereon, as, in the opinion of the Board, the raising of the lake would furnish sufficient water for years to come.

November 17th, the hotel keepers asked for a hearing in regard to their water rates, *being their first bills after the application of meters;* which was granted. December 6th they appeared by Counsel, and, on the 13th, had leave to withdraw. They refused, however, to pay; and, by mutual agreement, the case was carried to the Supreme Judicial Court and a hearing was had on the same; but the Decision of the Judges was not given until the year 1861. "The counsel for the plaintiffs contended —

"1. That the power to fix the price and rents of water was in the City Council alone, and could not be delegated to the Water Board, or any other City officer.

"2. That the citizens using water had a right to have the judgment and discretion of the City Council upon the price to be paid.

"3. If the ordinances were otherwise within the authority of the City Council, they were uncertain, unreasonable, and, therefore, void.

"4. But the plaintiffs were charged several times as much under these pro visions as under the price fixed by the City Council.

"5. Hotel-keepers using the same quantity might, under these provisions, be charged at rates differing as one to four at the will of the Water Board or Water Registrar.

"6. Even if the Ordinance was valid, this specific water rate should have been assessed by the Registrar, and not by the Water Board.

"7. It should have been assessed on the last of January for the year, and not quarterly.

"In the elaborate opinion of the Court, all these points were overruled; and it was decided that, upon a proper interpretation of the provisions of the statutes and ordinances bearing upon the subject, none of the objections urged by the plaintiffs against the proceedings of the Water Board in fixing the price or rent to be paid for water taken by them could be sustained. Judgment was accordingly rendered for the City. As this was a test case, the other hotel proprietors, who had refused to pay the rates assessed, subsequently paid them, amounting to $9,526.50."

On December 23d, an Ordinance was passed by the City Council, directing that all rates for water furnished through meters should be collected quarterly.

Several petitions were received from various parties during the month of December for the use of the water to form Skating Parks, which were granted the parties paying for the estimated quantity. There was also a petition received, during the summer, from Mr. W. W. Clapp, Jr., for the free use of water for a fountain, to be erected, if such use should be granted, in West Chester Square. The Board reported, as in all the previous cases which have been mentioned, that they had no power whatever to grant the free use of the water. (The City Documents, for 1859, are Nos. 8, 40, 49, 56.)

## 1860.

On January 16th, Mr. W. F. Davis was re-elected Water Registrar. The Annual Election of the Water Board took place on February 6th, when the following persons were elected:—

| | |
|---|---|
| Clement Willis, | George P. French, |
| G. E. Pierce, | George Dennie, |
| John H. Wilkins, | Ebenezer Johnson, |

Samuel Hall.

Mr. Johnson, however, was not elected until February 20th. They met, for organization, February 15th, when John H. Wilkins was re-elected President, and Samuel N. Dyer, Clerk; and Messrs. Stanwood and Knowlton were re-elected Superintendents of their respective divisions.

In May, Mr. Knowlton was instructed to replace the stakes showing the boundaries of the City's land bordering on the lake, with stone posts.

In May, after the completion of the laying of the new main, the Board sent a communication to the City Council (City Document No. 45, 1860), giving a full account of the undertaking.

On June 5th, Mr. Wilkins sent his resignation to the City Council, which was accepted; and, on July 2d, L. Miles Standish was elected to fill the vacancy. At the meeting of the Board, June 6th, they passed the following resolution:

*Resolved,* That the thanks of this Board be presented to the Hon. John H. Wilkins, for the faithful, impartial, and highly satisfactory manner in which he has discharged the important duty as President of the Cochituate Water Board, for the last four years; and that he goes into retirement with our highest respect as a gentleman, and an honest man.

Mr. Wilkins survived but a year and a half after his retirement from the Board, having died December 5th, 1861, at the age of 66 years, 11 months, 25 days. Immediately after his resignation, Mr. Johnson was elected President of the Board; which office he held until April 1865.

Several petitions having been sent to the City Council, from various persons in the City of Charlestown, asking to have their cisterns filled with the Cochituate water, by means of hose attached to the fire hydrants, the Board were authorized to fill the same, if in their judgment it was expedient; whereupon it was voted to grant the request: and the Superintendent of the Eastern Division was authorized to fill the cisterns, and to charge for the water at the rate of five dollars per hour while running through the hose.

June 20th, the Board sent a Communication asking for authority, and an appropriation, to change the 30-inch pipe to a 36-inch, from Waltham to Dover Street, 636 feet. July 14th, authority was given the Board to make the change, and an appropriation made of $16,000, to meet the expense; and in October, a further appropriation was made of $2,000. The total cost was $17,398.26.

In the month of December, several Skating Parks were supplied with water, the same as the year previous. There was a Committee chosen, during the year, to consider the expediency of making the water free; but they reported, December 17th, that it was inexpedient. (City Documents on the subject of Water, for 1860, are 13, 45.)

# CHAPTER XX.

## 1861 to 1864.

Election of Water Registrar — Election and organization of the Water Board for 1861-2 — Additional Act for the protection of the Works — Dudley Pond connected with the Lake — Lower Dam at the Lake raised — Question of uniting the Water Board's and Registrar's offices — Hopper Closets — Steam Engine purchased for machine shop — But one Service Pipe in each building — New Fence to Warren Bridge — New Pipe to East Boston recommended — Election of Water Registrar, 1862 — Water for the Navy Yard — Ordinance relating to the election of Water Board — Election and organization of the Board for 1862-3 — Black Bass put into Lake and Reservoir — First mention of a new Reservoir — Election of Water Registrar for 1863-4 — Election and organization of the Water Board for 1863-4 — Resignation of Mr. Stanwood — Election of his successor — Removal of office from Washington to Chauncy Street — Water allowed for power meters — Right to give permission to open Hydrants — Annual visit to the Lake — First action on the construction of a new Reservoir — The 30-inch mains connected on the Common.

On January 18th, W. F. Davis was re-elected Water Registrar, and the annual election of members of the Water Board took place on February 18th, 1861, when the following persons were chosen: —

| | |
|---|---|
| Samuel Hatch, | George P. French, |
| Jabez Frederick, | George Dennie, |
| Ebenezer Johnson, | Samuel Hall, |

L. Miles Standish.

Messrs. Hall and Standish, however, were not elected, in concurrence, until February 25th. They met for organization on March 1st, when Ebenezer Johnson was re-elected President, and Samuel N. Dyer, Clerk; and Messrs. Stanwood and Knowlton were re-chosen Superintendents of their respective departments. It was also voted to employ Mr. S. N. Dyer, Jr., as Assistant Clerk.

The Mayor was requested May 13th, to petition the Legislature for additional legislation for the better protection of the Water Works; and, upon the application being made, an act was passed making the punishment for

corrupting the water, or injuring any of the works, a fine not exceeding $1,000, and imprisonment not exceeding one year; or confinement to hard labor, in the State Prison, for a term not exceeding ten years.

The only act of importance by the Board this year, was the laying of an iron 18-inch pipe about eight hundred feet in length, to connect Dudley Pond with the lake.

On November 29th, the vote was passed to make this connection; and the work immediately commenced. It was completed, and the water let into the lake, January 31st, 1862. The cost of making this connection was $17,472.23.

Among the votes passed by the Board during the year, which are of historical account, were the following:

July 2nd, Mr. Knowlton was instructed to raise the lower dam at the lake.

November 12th, it was voted that on and after January 1st, 1862, no "hopper closets" should be allowed to be placed in any building or premises to which the Cochituate water is supplied, and that public notice be given of the same. The Board having no power to enforce this regulation, it became a dead letter.

November 26th, it was voted to put a steam engine into the machine shop on Federal Street; previous to this, the works had been run by an hydraulic engine.

December 24th, it was voted that but one service-pipe should be entered into any building, unless by order of the Board.

In their Annual Report, the Board state that a new fender had been put on the entire length of Warren Bridge and made secure; and they also recommend the laying of another pipe of a larger size to supply East Boston, and that it be carried across Meridian Street Bridge.

## 1862.

Mr. William F. Davis was re-elected Water Registrar, January 20th, 1862.

On February 17th, the United States Government asked to have the Navy Yard supplied with the Cochituate water; this petition was referred to the Committee on Water, who reported, March 3d, that the same be granted, under such regulations and conditions as the Water Board should deem for the interest of the City; which Report was accepted, and the petition was referred to the Water Board with full power.

June 11th, water was granted to the Navy Yard under the following conditions, which were complied with, viz: That the expense of the pipe and

laying it, and of furnishing a meter, should be paid by the Government; the pipe to be approved by, and laid under the supervision of the Superintendent of the Eastern Division, and the meter to be approved by, and to be under the control of the Water Board; the Board also reserving the right to shut off the water whenever it was deemed expedient, in order to keep up the quantity necessary for domestic use in the City. This supply was discontinued in 1865, on the completion of the Mystic Water Works.

On the 17th of March, 1862, the present Ordinance relating to the Election of the Water Board was passed. It provides that the Board shall consist of seven members; that one member shall be elected from the Board of Aldermen, two members from the Common Council, and four from the citizens at large, two of whom shall be elected for one year, and two for two years; and that, after the first election, there shall be elected, annually, one member of the Board of Aldermen, two members of the Common Council, who shall hold their office for one year, and two citizens at large, who shall hold their office for two years.

Previous to the passage of this Ordinance, the Board consisted of one member from each branch of the City Council, and five members from the citizens at large, all of whom were chosen annually.

The annual election took place on March 31st, 1862, when the following persons were chosen:—

John F. Pray, from the Board of Aldermen.
Jabez Frederick and George Hinman, from the Common Council.
Ebenezer Johnson and J. C. J. Brown, citizens at large for one year.
George Dennie and George P. French, " " " two years.

The Board met for organization April 2d, when Ebenezer Johnson was re-elected President, S. N. Dyer, Clerk, S. N. Dyer, Jr., Assistant Clerk, and Messrs. Stanwood and Knowlton, Superintendents of their respective divisions.

During this year, the only transactions of interest were the following:

1st. Through the liberality of S. T. Tisdale, Esq., of East Wareham, the Board procured some black bass to stock the Lake and Brookline Reservoir, for the purpose of destroying the eels and other small fish which get into the pipe, and cause much trouble and expense. This has evidently remedied the evil.

2d. The completion of the connection of Dudley Pond, January 31st.

3d. The settling of the claims for drawing down the water from Dudley Pond. This, however, was not completed until December 29th, 1866.

In the Annual Report for this year, the first mention of the want of a new Reservoir is made thus: "It is the opinion of this Board, that it will be for the interest of the City, at some future time, when the affairs of our country are in a more prosperous condition, to build a new Reservoir, somewhere near this end of the Aqueduct, for the storage of all surplus water which the lake can furnish; it would also be of great importance in case of any accident to the Aqueduct, for we should thus be better able to furnish the City with water while repairing."

## 1863.

William F. Davis was re-elected Water Registrar, February 12th, 1863; and on March 30th, the annual election of the Water Board took place, when the following persons were chosen: —

L. Miles Standish, from the Board of Aldermen.

Jabez Frederick and George Hinman, from the Common Council.

Nathaniel J. Bradlee and Ebenezer Johnson, citizens at large, for two years.

The members of the old Board, whose term had not expired, were George Dennie and George P. French.

They met for organization April 6th, when Ebenezer Johnson was re-elected President, S. N. Dyer, Clerk, S. N. Dyer, Jr., Assistant Clerk, and Messrs. Stanwood and Knowlton, Superintendents of the Eastern and Western Divisions.

Mr. Albert Stanwood, Superintendent of the Eastern Division, sent in his resignation, which was laid on the table; but, on July 1st, it was accepted, and Mr. Ezekiel R. Jones was elected to fill the vacancy. On motion of Mr. Frederick, The following vote was passed:

*Ordered*, That the thanks of this Board be tendered to Mr. Albert Stanwood, for the highly satisfactory manner in which he has performed the duties of Superintendent of the Eastern Division, and he retires from this department with our best wishes for his success. And it was Ordered, That as a mark of appreciation of his services, Mr. Stanwood's pay be made up to the first of October next.

There had been considerable discussion in regard to uniting the office rooms of the Water Board and Water Registrar, ever since the first organization of the Board; and, April 22d, Messrs. Johnson, Standish and Bradlee were chosen a Committee to consider the expediency of such union, and report.

At the next meeting, they reported in favor of moving to Chauncy Street, in the room adjoining the one to which the Water Registrar had just removed, on account of the rebuilding of the City Hall, and the Report was accepted by a vote of four to three. The same Committee were authorized, with full power, to move the office before July 1st. This vote was carried into effect June 3d.

August 15th, leave was given to the Boston Music Hall Association to use a "power meter," to blow their Organ, and on September 9th leave was granted to the Second Church, for the same purpose.

September 9th, a Resolution was passed, that the right to give permission to open Hydrants was vested in this Board only. This was passed because several persons connected with the different departments of the work had been in the habit of giving permits to open them; and the Board decided that it must be stopped, as no one was responsible. Notice of the above resolution was given to all persons interested.

Previous to this year, the annual visit of the City Government to the Lake was by order of the City Council, they inviting the Board; this year, however, the Board believing it to be for the interest of the City that they should have the control and management of these visits, invited the City Government to accompany them to the Lake on Friday, September 25th, and the invitation was accepted.

The subject of a new Reservoir was brought directly before the Board, for action, on October 21st, 1863, by the following Order.

*Ordered*, That in the opinion of this Board, the safety and convenience of the citizens of Boston require an additional Reservoir, either in the town of Newton, Brookline, or Brighton; and in order to facilitate the accomplishment of this object, the Committee on the Western Division is hereby instructed to ascertain if a suitable lot of land, not less than one hundred acres, can be obtained for that purpose; and, if possible, to obtain a bond for a deed of the same, running not exceeding six months; and said committee are also authorized to cause surveys to be made of the same, and to report to the Board, as early as possible. A Committee was chosen, but

no definite action was taken, except the selection of the present location of the Chestnut Hill Reservoir, as the one best adapted to the wants of the City.

During this year, the 30-inch main on the Common was connected with the main running through Boylston Street. There being no connection between these pipes, except at Chester Park, it was thought best to unite them on the Common, in case of accident or break.

The settlement of the claims for drawing down the water of Dudley Pond, most of which were settled this year, were as follows: —

| | | | | | |
|---|---|---|---|---|---|
| To John M. Wiggin, of Wayland, | July | 22, | 1862, | . . . | $125 |
| " Ebenezer Johnson, of Boston, | August | 29, | " | . . . | 50 |
| " J. M. Bradshaw, of Wayland, | October | 11, | " | . . . | 150 |
| " James A. Loker, " | December | 10, | " | . . . | 50 |
| " George Bullard, of Framingham, | " | 29, | " | . . . | 50 |
| " Samuel M. Thomas, of Wayland, | January | 7, | 1863, | . . . | 350 |
| " Thomas J. Damon, of Natick, | " | 7, | " | . . . | 225 |
| " Patrick Coughlin, of Wayland, | " | 7, | " | . . . | 75 |
| " Thomas McCam, " | " | 7, | " | . . . | 60 |
| " Lois Sanders, " | " | 7, | " | . . . | 60 |
| " Thomas F. Hammond, of Natick, | March | 4, | " | . . . | 200 |
| " Samuel D. Reeves, of Wayland, | " | 9, | " | . . . | 12 |
| " Lucretia Reeves, " | May | 9, | " | . . . | 6 |
| " James M. Burt, " | November | 4, | " | . . . | 200 |
| " W. H. Hills, " | " | 9, | " | . . . | 730 |
| " Clarissa H. Dudley, of Concord, | December | 22, | " | . . . | 225 |
| " Cynthia Hammond, of Wayland, | June | 7, | 1864, | . . . | 25 |
| " Edward Rice, of Brighton, | December | 29, | " | . . . | 100 |
| Total payments, . . . . . | | | | | $2,693 |

# CHAPTER XXI.

## 1864 TO JANUARY 1868.

Election of Water Registrar for 1864-5 — Right purchased to divert the water of Broad Brook — Election and organization of the Water Board for 1864-5 — Election of Superintendents and Clerks — Copies of Deeds to and from the City — Board to give permission to lay main pipe — Leave granted to maintain the pipe over the Mill-dam — Waste of water and appointment of Inspectors — Action of the Board and City Council on the subject of a new Reservoir — Application of Meters — Ordinances passed during the year 1864 — Change in the Water Rates for measured water — Election of Water Board for 1865-6 — Vote of thanks to the President — Organization of the Board, and election of Clerks and Superintendents — Act authorizing the City to build new Reservoir — Leave granted to purchase land, and make surveys — Land and Construction Committees appointed — Change in the location of Beacon Street — Land purchased for Reservoir — Second appropriation for Land granted — Estimates of cost — Lawrence Meadow added — Third appropriation for Land — Order for the Board to construct Reservoirs — First appropriation for construction — Contract for Meters — Petition for damages to goods kept under the sidewalk, and Report thereon — Abatement of charge by Meter for unavoidable waste — Water for Fountains — Raising Pipe on Tremont Street — Return of the Spade — Change of time for making Annual Report — Brookline Taxes — Several questions submitted to the City Solicitor and his reply — Engineer's Report on Levels at the Lake — Question of removing the Conduit considered and decided — Appointment of Resident Engineer at Reservoir — Examination of the South Boston Main Pipe — Death of Edward F. Knowlton — Appointment of Albert Stanwood as Superintendent at Reservoir — Election of Water Board for 1866-7, and their Organization — Work on the Reservoir — Resignation of Otis Norcross as President — Election of John H. Thorndike as President — Election of Registrar — Election of Water Board for 1867-8 — Letter of the Commissioners on the annexation of Roxbury to Boston, and reply of the Board — Organization of the Board — Library for the Water Board — Strength of Water Pipes — Acceptance of Mr. Gardner Brewer's offer of a Fountain for the Common — Annual Report of the Board — Bridge over Railroad at Tremont Street — Freshet — Quantity of water for each inhabitant — Magnesium Light for examining Aqueduct — Drinking Fountains — Chestnut Hill Reservoir — Results of system of Inspectors — Cost of Works.

ON the 11th of February, 1864, William F. Davis was re-elected Water Registrar.

March 23d, the Committee on the Western Division were authorized to

purchase the right to draw the water of Broad Brook on the east side of Dug Pond; and they secured the right forever, by the payment of five hundred dollars.

The annual election of the Water Board, for 1864–5, took place March 3d, 1864, when the following persons were chosen: —

L. Miles Standish, from the Board of Aldermen.
Jonas Fitch and Alexander Wadsworth, from the Common Council.
George Dennie and Martin Brimmer, citizens at large.

The terms of Messrs. Ebenezer Johnson and Nathaniel J. Bradlee were unexpired.

On the 7th of March, Mr. Brimmer declined; and on the 24th, Mr. John H. Thorndike was chosen to fill the vacancy.

They met for organization April 4th, when Ebenezer Johnson was re-elected President, and S. N. Dyer, Clerk; and on May 11th, Messrs. Knowlton and Jones were re-elected Superintendents, and S. N. Dyer, Jr., Assistant Clerk.

April 4th, a vote was passed, directing that copies of all the Deeds to and from the City concerning the Water Works should be made under the supervision of Messrs. Johnson and Thorndike. This work was commenced the next year, and completed in the year following.

It having been the custom to lay a main pipe in any street where water was required, without asking permission of the Board, it was voted, that in future no main pipe should be laid without their approval.

May 13th, the act giving the right to maintain the Main over the Mill-dam was passed by the Legislature as follows:

"Section 1. The City of Boston shall have the right to maintain its water pipes as the same are now laid, in the Mill-dam and other lands of the Commonwealth in and near said city, subject to the provisions of this act, *provided*, that any person whose property is injured thereby shall have his damages ascertained, and paid in the manner set forth in the several acts to which this is in addition; and *provided, further*, that if, at any time hereafter, the legislature shall order a draw to be made through the said mill-dam, or other lands on the line of said pipes, for the purposes of navigation, the City of Boston shall so adapt its said pipes, at the locality of the draw, as not to interfere with a free passage of boats and vessels through such draw.

"Sect. 2. Said city may enter upon and dig up the ground in said Mill-dam and other lands, when necessary, for the purpose of repairing or replacing said pipes; *provided, however*, that said Mill-dam and lands shall be restored by said city to as good order and condition as the same were in before such digging is commenced, and that the work shall be done, in such manner and with such care,

as not to render any road, street or way, in which said pipes are laid, unsafe or unnecessarily inconvenient to the public travel thereon.

SECT. 3. The City of Boston shall at all times save harmless and indemnify the Commonwealth, and any city or town which may become liable to keep in repair any road, street or way aforesaid, against all damages which may be recovered against them respectively, and shall reimburse to them respectively all expenses which they shall reasonably incur by reason of any defect or want of repair in such road, street or way, caused by the maintenance, repairing or replacing of said pipes, or by reason of any injury to persons or property caused by any defect or want of repair in said pipes, *provided* that said city shall have due and seasonable notice of all claims for such damages or injury, and opportunity to make a legal defence thereto.

" SECT. 4. This Act shall take effect from its passage."

October 12th, on account of the low state of the water in the lake, and the enormous waste in the city, it was voted to give public notice in the newspapers, and, also, to send a notice to each house, calling upon the citizens to use every means in their power to prevent the waste. A few weeks later, the Mayor also issued a notice stating the exigency of the case, and the importance of saving the water.

These notices had a very good effect, but were not by any means sufficient to put a stop to the evil; and it was therefore voted, December 21st, to employ twenty men as special Inspectors to visit and inspect the premises of every water-taker, and report daily at the office all cases of waste. This was immediately carried into execution, and the result was, that the quantity drawn was reduced one-half.

During the year the subject of a new Reservoir was constantly before the Board, and several private interviews in relation to the same were held with the Mayor and members of the City Government. August 31st, a Committee of the Board was chosen to consider the subject and report; and September 19th, they made a verbal Report, accompanied by two plans of location submitted by Mr. Crafts, City Engineer; one, the present location, comprising one hundred acres, and the other, about fifty acres, situated between Chestnut Hill and Webber's Barn; and the Board decided unanimously to recommend to the City Council the adoption of the location for the one of the larger size. September 28th, a committee was appointed to procure bonds for deeds, but they were unable to obtain them.

July 25th, an Ordinance was passed in regard to laying pipes in unaccepted streets. (See Ordinances, 1864, pages 89 and 90.)

August 10th, a petition was sent by Holmes and others to the City Council

to have the Cochituate water supplied to the houses on Lawrence Street, the Board having refused to supply them, as the street was below grade. (See City Document, No. 68.)

September 14th, a filtering dam was ordered to be erected at Pegan Brook.

October 12th, the President was authorized to communicate to the City Council the absolute necessity of a new Reservoir; this communication was referred to the Committee on Water, who had several interviews with the Board, and also visited the proposed location in company with the Mayor and Aldermen; and, on October 17th, an Order was passed by the City Council requesting the Mayor to petition the Legislature for an act to enable the City to build such a Reservoir, and to raise money to defray the expense thereof and a petition was forwarded by him accordingly.

On the 24th of October, the Committee on Water recommended the passage of the following Orders, which were adopted by the City Council, and approved by the Mayor, December 13th:

*Ordered*, That the Cochituate Water Board be, and they are hereby, authorized to purchase such land as they may deem expedient and necessary for the location of a new Reservoir on the line of the Aqueduct, at a cost not exceeding Fifty Thousand Dollars.

*Ordered*, That the Treasurer be and hereby is authorized to borrow, under the direction of the Committee on Finance, the sum of Fifty Thousand Dollars, the same to be appropriated to the purchase of land by the Cochituate Water Board for a new Reservoir.

December 13th, it was voted by the Board that in all buildings which are or shall be supplied with the Cochituate water through meters, the water-rate for each building may be assessed or taxed to the owner or occupant thereof without reference to the number of tenants there may be in such building. This was passed by yeas and nays; Messrs. Johnson, Dennie, Bradlee, Fitch and Wadsworth voting in the affirmative, and Messrs. Standish and Thorndike voting in the negative. It was also voted, on the same day, six to one, the President voting in the negative, to recommend to the City Government to adopt a uniform rate of three cents per hundred gallons for measured water.

December 21st, a new Ordinance was passed in regard to the use of hose.

## 1865.

The recommendations of the Water Board in regard to the Rate for measured water was referred by the City Council back to the Board, with instructions to give a hearing to Messrs. Harvey D. Parker and others, the

petitioners. The hearing took place January 13th, 1865; and on the 28th, a committee was appointed to ascertain the exact amount of water consumed in twenty-four hours, and report to the Board. The investigation of this committee, with the views of the Board who still recommended, with one exception, the adoption of the three-cent rate, were submitted to the City Council March 11. (City Document, No. 35.)

April 3d, Messrs. H. D. Parker and others, not satisfied with the Report of the Water Board, upon the hearing given them by direction of the City Council, again petitioned that body for, and obtained a hearing before the Committee on Water. No action being taken on the subject, Joseph F. Paul and others sent a Petition, asking that a uniform rate might be immediately adopted; and on the 29th of April, the Board of Aldermen passed an ordinance, making the rate two and a half cents, which, by a vote of the Council, on June 6th, was referred to the Committee on Water. This committee made their Report, September 28th, recommending three cents. (City Document, No. 69.) The Board of Aldermen, however, passed the ordinance by substituting two cents and a half, and the Council refused to concur.

October 5th, the Water Board sent to the City Council a second communication, giving a financial statement, showing the annual expenses and interest on the cost of the Water Works, and the deficiency of the annual income therefrom, and urging the necessity of the three cent rate. (City Document, No. 76.)

A Committee of conference of the two branches of the Council reported October 30th, that they were unable to agree. November 22d, after several proposed amendments, which were non-concurred in by the Common Council, the present three-cent rate was adopted.

The annual Election of members of the Cochituate Water Board for 1865–6, took place February 9th, when the following persons were chosen:

L. Miles Standish, from the Board of Aldermen.
Jonas Fitch and Alexander Wadsworth, from the Common Council.
Otis Norcross and Nathaniel J. Bradlee, for two years.

The terms of George Dennie and John H. Thorndike were unexpired.

The new Board met for organization April 3d, when Otis Norcross was elected President, and S. N. Dyer, Clerk, and S. N. Dyer, Jr., Assistant Clerk, and E. F. Knowlton and E. R. Jones, Superintendents. William F. Davis was re-elected Water Registrar, February 27th.

March 29th, being the last meeting of the previous Board, it was voted, on

motion of Mr. Dennie, that the thanks of the Board be presented to the President, Ebenezer Johnson, Esq., for his prompt, efficient, faithful and valuable services, rendered to the City of Boston for the past eight years, as a member of this department of the Government, and that this vote be placed upon the records of the Board.

One of the most important transactions of the year was the commencement of the new Reservoir, which, by a vote of the Board, passed May 9th, will be known as the CHESTNUT HILL RESERVOIR.

February 24th, a committee was chosen to confer with the City Solicitor in regard to the hearing on the Petition before the Legislature for power to construct this Reservoir; and, at his request, several members of the Board were present at the hearing. As no one appeared to object, the following Act was reported and finally passed by the Legislature, and approved by the Governor, April 4th.

COMMONWEALTH OF MASSACHUSETTS.

1865.

*An Act to authorize the City of Boston to build an additional Reservoir.*

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same as follows:

SECTION 1. The City of Boston is hereby authorized, by and through the agency of the Cochituate Water Board therein, or by and through any other agency which shall be established therefor by the City Council of said city, to construct and maintain an additional Reservoir for receiving, holding and distributing water; and, for this purpose, may take and hold, by purchase or otherwise, any lands or real estate, not exceeding two hundred acres, in the towns of Newton, Brighton and Brookline, and lying between the air-line Railroad, the present line of the said city's Aqueduct and Beacon Street on the south, Rockland and Brighton streets on the east, South Street on the north, and a street leading from said South Street to said Beacon Street on the west; provided, however, that no part of the tract of land, comprising the Evergreen Cemetery in the town of Brighton, shall be so taken and held otherwise than by purchase.

SECT. 2. The City of Boston may also, by and through the same agency, lay and maintain one or more suitable lines of pipes from the said Reservoir to a convenient point in its line of pipes leading from its Reservoir in said Brookline to said city, and may take and hold by purchase or otherwise such lands or real estate as may be necessary therefor; and may carry and conduct the said pipes over or under any water course, or any street, turnpike road, railroad, highway or other way, in such manner as not to obstruct or impede travel thereon;

and may enter upon, and dig up any such road, street, or way, for the purpose of laying the said pipe, and for maintaining and repairing the same.

SECT. 3. The City of Boston shall at all times save harmless and indemnify any city or town which may become liable to keep in repair any road, street or way aforesaid, against all damages which may be recovered against them respectively, and shall reimburse to them respectively all expenses which they shall reasonably incur by reason of any defect or want of repair in such road, street, or way, caused by the maintenance, repairing or replacing of said pipes, or by reason of any injury to persons or property caused by any defect or want of repair in said pipes; provided that said city shall have due and reasonable notice of all claims for such damages or injury, and opportunity to make a legal defence thereto.

SECT. 4. The City of Boston shall be liable to pay all damages that shall be sustained by any persons in their property by the taking of any land or real estate as aforesaid, or by any of its doings under this act; and in regard to such taking, and the ascertainment and payment of all such damages, the City of Boston, and all persons claiming damages, shall have all the rights, immunities and remedies, and be subject to all the duties, liabilities and obligations which are provided in the one hundred and sixty-seventh chapter of the acts of the year one thousand eight hundred and forty-six, the one hundred and eighty-seventh chapter of the acts of the year one thousand eight hundred and forty-nine, and the three hundred and sixteenth chapter of the acts of the year one thousand eight hundred and fifty.

SECT. 5. For the purpose of defraying all the costs and expenses of such land and real estate as shall be taken, purchased or held for the purposes mentioned in this act, and of constructing said Reservoir, laying said pipes, and doing all other things incident thereto, the said City Council shall have authority to issue, from time to time, notes, scrips, or certificates of debts, to such an amount as may be necessary, and in such form, on such length of time, and bearing such rate of interest, not exceeding six per centum per annum, as they shall deem expedient.

SECT. 6. This act shall take effect upon its passage.

House of Representatives, April 1st, 1865 — Passed to be enacted.

ALEX. H. BULLOCK, *Speaker.*

In Senate, April 4th, 1865 — Passed to be enacted.

J. E. FIELD, *President.*

April 4th, 1865 — Approved.

JOHN A. ANDREW

On April 8th, the Board asked for authority from the City Council to purchase land for the Reservoir, and on the 10th, the following Orders were passed, which were approved by the Mayor on the 24th.

*Ordered,* That the Cochituate Water Board be, and they are hereby authorized to take and hold by purchase or otherwise, any lands or real estate, not exceeding two hundred acres, in the towns of Newton, Brighton and Brookline, [then follows a description of location, the same as in the act before referred to,] pursuant to the provisions, and subject to the conditions of an act of the legislature of Massachusetts, passed April 4th, 1865, entitled, "an Act to authorize the city of Boston to build an additional Reservoir."

*Ordered,* That the Cochituate Water Board be also authorized to make surveys, and report to the City Council plans and estimates of the construction of the proposed Reservoir, and that the expense of this and the preceding orders be charged to the appropriation authorized for this purpose, on the 13th of December, 1864.

After the passage of the preceding act of the Legislature and the orders of the City Council, it became necessary that the Board should take immediate action thereon, and on April 26th, the following committees were appointed for that purpose:—

On the purchase of land, Messrs. Norcross, Dennie, Wadsworth and Fitch. On construction, Messrs. Norcross, Standish, Bradlee and Thorndike.

These committees immediately commenced active operations, the former in the purchase of land, and the latter, in consulting with the City Engineer, in preparing the plans and estimates. Soon after the commencement of the plans, it was deemed advisable to increase the size of the Reservoir by adding the tract of land lying south of Beacon Street, east of Chestnut Hill and north of the Charles River Railroad, if Beacon Street at this locality could be discontinued, and a new road around the addition substituted therefor.

Accordingly, the President was authorized to petition the County Commissioners to discontinue that portion of said street, which he did on the 29th of May; a hearing was had on the premises, before the County Commissioners, July 12th, and the petition was granted at that time, no one appearing in opposition thereto.

The first purchase of land for Chestnut Hill Reservoir was made on July 11th, of Theodore Monroe. The total amount purchased to May 31st, 1867, was as follows:—

| Date. | | | A. | Qr. | Rds. | Ft. | | Amount. |
|---|---|---|---|---|---|---|---|---|
| July 11th, 1865, | of | Theodore Monroe, | 13 | 1 | 38 | 40 | Consideration, | $8,093 00 |
| " 13th, " | " | Elizabeth A. Brown, | 10 | 3 | 24 | 0 | " | 6,540 00 |
| " 13th, " | " | C. H. B. Breck, | 8 | 0 | 27 | 0 | " | 4,901 25 |
| Aug. 1st, " | " | Andrew J. Monroe, | 6 | 3 | 34 | 0 | " | 4,177 50 |
| " 1st, " | " | Sarah Monroe, et al., | 18 | 3 | 0 | 0 | " | 11,250 00 |
| " 2d, " | " | William Warren, | 22 | 2 | 0 | 0 | " | 10,000 00 |
| " 30th, " | " | Mary Ward, | 17 | 2 | 31 | 0 | " | 8,846 87 |
| Oct. 4th, " | " | Heirs of Dana Dowse, | 17 | 2 | 36 | 59 | " | 9,000 00 |
| " 16th, " | " | Henry Lee, Jr., | 5 | 0 | 26 | 0 | " | 2,581 25 |
| Dec. 8th, " | " | Amos A. Lawrence, | 58 | 1 | 1 | 0 | " | 31,481 87 |
| Jan. 30th, 1866, | " | George A. Wilson, | 20 | 0 | 3 | 0 | " | 12,011 25 |
| Feb. 16th, " | " | Jonas Stone, | 0 | 3 | 9 | 0 | " | 750 00 |
| Mch. 5th, " | " | Daniel Knowles, | 3 | 0 | 28 | 0 | " | 693 75 |
| April 13th, " | " | William White, | 1 | 2 | 18 | 0 | " | 1,500 00 |
| May 19th, " | " | Heirs of James Brown, | 2 | 2 | 8 | 0 | " | 1,730 00 |
| Nov. 17th, " | " | Daniel Knowles, | 2 | 2 | 31 | 0 | " | 3,232 50 |
| " 17th, " | " | William White, | 0 | 1 | 0 | 215 | " | 808 10 |
| Dec. 3d, " | " | Amos A. Lawrence, | 1 | 0 | 33 | 0 | " | 1,206 25 |
| Area of Beacon Street, discontinued, | | | 3 | 0 | 6 | 188 | " | |
| Total area and cost, | | | 212 | 2 | 34 | 233 | | $118,803 59 |

Several acres can be sold, on the completion of the Reservoir, with such restrictions as may be necessary to protect its margin. In the deed from Daniel Knowles, it is stated that no Slaughter House or Piggery shall be erected upon the land adjoining that sold to the City of Boston, and lying between that sold and the road. All the titles were examined by W. P. Thompson, Esq., of East Cambridge.

The original appropriation of $50,000 for the purchase of land having been expended, the Board, July 14th, asked for a further appropriation of $30,000, which was referred to the Committee on Water, who reported in favor of granting the same, and an Order was passed, authorizing the Treasurer to borrow the amount, and approved by the Mayor, September 9th.

The committee, in their Report, state that "they have visited the location of the new Reservoir, and are of the opinion that a lot of land, known as the 'Lawrence Meadow,' should be purchased, and added to the proposed Reservoir"; according to their suggestion, the City Council passed the following Order, August 7th:

*Ordered*, That the Cochituate Water Board inquire and report to the City Council for what sum the "Lawrence Meadow," so called, can be purchased,

and also what will be the additional expense of extending the dimensions of the new Reservoir so as to include said meadow within its limits.

In compliance with this Order, and the one passed April 24th, before referred to, the Board sent a communication to the City Council, October 16th, (City Document No. 85,) covering the approximate estimates, amounting to $779,024, without the Lawrence Meadow, which would add $122,340, a total cost of $901,364. It also stated that "in case it is found, after a careful examination, best and necessary to carry the Conduit around the Lawrence Meadow, instead of allowing it to remain in its present position, there will be an additional cost of about $15,000.

In the same report, they state that

| | | |
|---|---|---|
| The water area of the Lower Reservoir is about | 92 | acres. |
| " " " Lawrence Meadow is | 34 | " |
| Total | 126 | " |
| Total capacity of both | 730,000,000 | gallons. |
| Capacity of Lower Reservoir for the depth of ten feet below high-water mark is | 300,564,000 | gallons. |
| Capacity of Lawrence Meadow for the depth of ten feet below high-water mark is | 110,500,000 | " |
| | 411,064,000 | " |

They also say: "The Water Board are unanimous in the opinion that it will be for the interest of the City to include the 'Lawrence Meadow' in the proposed Reservoir." This communication was referred to the Committee on Water, who reported, October 30th, in favor of adding the "Lawrence Meadow," and recommended the passage of the following Orders, which were passed, and approved by the Mayor, November 10th:

"*Ordered*, That the Cochituate Water Board be, and they hereby are authorized to take, by purchase or otherwise, for the purpose of constructing a portion of the Chestnut Hill Reservoir thereon, the 'Lawrence Meadow,' so called, in Newton and Brighton, belonging to Amos A. Lawrence and others, containing fifty-two acres, more or less.

"*Ordered*, That the Treasurer be, and he is hereby authorized to borrow, under the direction of the Committee on Finance, the sum of Thirty Thousand Dollars, the same to be appropriated for the purchase or acquirement of the 'Lawrence Meadow,' so called, in Newton and Brighton, whereon to construct a portion of the Chestnut Hill Reservoir, heretofore authorized by the City Council."

The same committee subsequently reported that they had examined the estimates, and approved of the same, and recommend the passage of the following Orders, which were passed and approved by the Mayor, November 17th:

*Ordered*, That the Cochituate Water Board be, and they hereby are, authorized to construct upon the land acquired, or to be acquired, for that purpose, near Chestnut Hill, in Newton and Brighton, a NEW AND SUBSTANTIAL RESERVOIR, of a capacity of not less than 500,000,000 gallons, and at an expense not exceeding $900,000.

*Ordered*, That the Treasurer be, and hereby is authorized to borrow, under the direction of the Committee on Finance, the sum of $300,000, the same to be expended by the Cochituate Water Board on account of the construction of the Chestnut Hill Reservoir in Newton and Brighton.

Immediately after the passage of these Orders, Mr. Edward F. Knowlton was appointed Superintendent of the Reservoir.

The only work done on the premises during the year was the surveying cutting down the trees, digging trenches; and building a new culvert to turn the brook at the junction of Beacon and Brighton streets, so as to be able to drain the meadow in the spring, the one already built not being of sufficient depth, and authority having been obtained, October 1st, from the Selectmen of Brighton to make this change.

The following transactions and items of interest occurred during the year. On April 19th, a contract was made with Mr. H. R. Worthington, of New York, for 500 $\frac{5}{8}$-inch and 100 1-inch meters, to be delivered within one year. These will, doubtless, be the means of adding largely to the increase of income, and will also reduce the consumption of water.

May 9th, a Petition having been sent to the Board for payment of damages supposed to be caused by a leak in the street Main in front of 243 Washington Street, the Committee on the Eastern Division, to whom it was referred, reported that they had visited the premises, and after hearing all the facts in the case, recommend that the petitioner have leave to withdraw; which report was accepted. The circumstances of the case were, — That the petitioner had applied to the city government, in 1863, for leave to construct an area under his sidewalk, which was granted with the usual condition that the petitioner would hold the city harmless from any and all damages that might arise on account of said construction.

Several applications having been made for allowance on bills for water furnished by meter, where the pipes had been broken without the knowledge

of the consumer until the bills were rendered, it was voted, on May 29th "That no abatement upon bills will be made by the Board upon claims for excess of quantity of water charged, unless such claims are made immediately upon the receipt by the claimant of the first bill showing such excess; and upon satisfactory evidence that effective measures have been taken by the claimant to prevent further loss or waste."

On June 26th, the Board of Aldermen passed an Order requesting the Water Board to communicate to them the reason which prevented the playing of the Public Fountains; to which the Board made a reply, July 3d, (City Document No. 57,) in which, after stating the general condition of the Lake and adjoining ponds, and the amount of water consumed by the several fountains, they say: — "Under the existing circumstances, and from our experience of last year, the Water Board consider it not only prudent, but a positive duty to husband the water in every reasonable manner."

On July 14th, it was decided to raise the two main pipes on Tremont between Waltham and Dedham streets; and September 1st, it was voted to extend the raising to Newton Street. This work was accomplished withou accident, and completed December 14th, at a cost of $16,322.91.

September 14th, the Water Board and Water Registrar's offices were removed from Chauncy Street to the present location in the new City Hall on School Street.

On October 9th, Samuel F. McCleary, Esq., the City Clerk, appeared at the meeting of the Board, and, in a felicitous speech, presented to the Board the spade with which the first earth was removed in the construction of the Aqueduct, it having been in his possession since that day.

On the application of the Water Board, the City Council passed an Ordinance, December 27th, changing the time for making the Annual Report from on or before the 15th day of January to during the month of May; th accounts to be made up to and including the 30th day of April. The object of this change was to have the Auditor's accounts, and those of the Water Board, agree; which could only be done by making up their accounts to April 30th, the time when the Auditor's and Treasurer's accounts are made up.

The Cochituate Water Board, in their annual Report for 1865, (City Document No. 61, p. 14,) in speaking of the right of the towns to tax the real estate connected with the Water Works, say:

"The town of Brookline has claimed the right to tax the Reservoir and other real estate connected with the Water Works, situated in that town, and

have levied taxes thereon. Believing that the property was not legally subject to taxation under the principle which, we were advised, universally prevails, that Corporations, chartered for public purposes, and for the public good, and not for private gain, hold their corporate property free from assessment for taxes, measures were taken to bring the claim of that town to a legal decision. An appeal was taken from the Assessors of Brookline to the County Commissioners of Norfolk County, and heard on the 27th day of December, 1865, when a decision was made in favor of the City, in accordance with the views we had previously entertained. The same question was raised before by the town of Wayland, and was decided finally by the Supreme Judicial Court. The decision may be found in the 4th volume of Gray's Reports, page 500.

January 1st, 1866, to January 1st, 1868.

On January 5th, in 1866, Questions in regard to the management of the Water Works were submitted to the City Solicitor, Mr. Healy, for his opinion; to which he replied, February 5th (See Water Board Records, page 109). He says:

"Before proceeding to answer specifically the several questions proposed in the accompanying paper, allow me to say generally that all questions like these are to be solved by determining whether the thing proposed to be done *is reasonable.* Cities are authorized to make reasonable ordinances and by-laws, and when these are subjected to a legal test, to determine their validity, the inquiry is, Are they reasonable? The following answers, therefore, are simply my opinion upon the reasonableness of the several regulations to which your questions have reference.

"The following were the questions submitted, and his replies thereto:

1*st Question:* Has an agent of the Water Board, an Inspector, a right to enter the dwelling-house of a water taker, at reasonable times, to inspect the water fixtures for the purpose of detecting waste or leaks? If the Inspector is refused admittance by the owners at such a time, have the Board authority to withhold the supply of water until the conditions are complied with? Is the refusal to admit the Inspector by the wife or domestic or any other member of the family, sufficient to justify the Board in cutting off the water?

"*Answer:* I have no doubt of the right of the Water Board to send an Inspector to examine any fixtures through which the Cochituate water is taken, whether they are in a dwelling-house or other building; and if admittance to the house or building is refused to the Inspector by the person who is responsible for the payment of the water rates, whether he be the owner or

tenant, the water may be cut off; such refusal by the wife or other members of the family of the water taker would not, I think, justify the cutting off, unless the person making the refusal acts under the direction, or with the concurrence of the water taker.

"*2d Question:* Have the Water Board the right to apply a Meter, for the measurement of the water, to a building occupied by several tenants, and assess all the water used, upon the owner of the estate? If, under Section 18th, of the act of March 30th, 1846, giving the City the right to introduce water, the owner of a building objects to being responsible for his tenant, can the Water Board cut off the supply of water until the owner or some other party become responsible for all the water used in the building?

"*Answer:* Applying a Meter, I can have no doubt, is a reasonable mode in any case, of ascertaining whether water is wasted, or used contrary to the rules and ordinances, or for purposes other than those for which the party is paying; and I believe it is competent to require one person — owner or tenant, as the case may be — to be responsible for the payment of the water, for all the water which is furnished through one supply pipe, whether it be a part or the whole of a building which is thus furnished with water. If a building is divided into several tenements, having separate supply pipes, the occupant of each tenement may rightfully claim a separate bill. When one person is required to be responsible, the water may be withholden or cut off, until the requirement is complied with.

"*3d Question:* If a tenant vacates a building, leaving a bill for water, which was assessed upon him, unpaid, the water, in consequence of such non-payment having been shut off, can the Water Board refuse to let the water on again, when requested by a new tenant, or the owner of the estate, until the old bill for water has been paid? (See City Ordinances, Water, Section 15.)

"*Answer:* The provisions of the 15th section of the Water Ordinances, to which you refer, appear to me to be unreasonable, and therefore invalid. The water rates are not like taxes, a lien upon the real estate, but every water taker is supplied upon his personal responsibility, and I can see no propriety in requiring one man to discharge the debt contracted by another, and with which he had no connection, of which he had no knowledge, and from which he has derived no benefit whatever.

"*4th Question:* Have all citizens a right to the water, provided they comply with the rules and ordinances in regard to its use? Is there any discrimination in the right between that for domestic, and manufacturing or shop use?

"*Answer:* All the citizens have equal rights to the use of the water, the circumstances being the same or similar in each case; yet I have no doubt of

the right of the city to limit the water to certain uses, and that it would be its duty to do so, in case the supply should be insufficient for all purposes. Water for domestic use must first be supplied, even to the exclusion of all other uses, except, perhaps, that of extinguishing fires.

"*5th Question:* Has the owner of an estate, upon an unaccepted street, a right to have the water entered upon his premises, until he has complied with the City Ordinances, passed July 30th, 1864, in regard to grades?

"*Answer:* Your fifth interrogatory, I must answer in the affirmative. When the subject of the ordinance of July 30th was under discussion, before the passage of the ordinance, I expressed the opinion to some members of the City Council, that such an ordinance would not, probably, be held valid by the courts, because it requires a higher grade for private ways than the city adopts for all its public streets; and because it requires the grade of cellars and yards to be higher on private ways than on public streets, as well as for other reasons; I see now no cause to change the opinion I then expressed.

"*6th Question:* If several persons occupy one building, and each party is assessed separately for his water rates, when one fails to pay, have the Board the right to cut off the supply of water to *all* until the delinquent's bill is paid?

"*Answer:* At first blush, it seems a hardship to deprive one person of the use of the water, for the wrongful act of another, when he has no control over that other person, or over his acts; but if that right did not exist, a dozen persons might use the water without payment therefor, because one person receiving his supply through the same pipe has paid for it. The paying person knows the rule, it is printed on his water bills, and he chooses to take the risk of the rule, rather than to provide himself with separate fixtures; there is an agreement, therefore, between all the persons taking the water from the same supply pipe to be jointly and severally responsible to the city for compliance with all the rules and regulations, so far as they apply to the common source of supply; in this view, I think the rule is reasonable."

The extreme cold of the eighth and ninth of January, of the present year, caused the freezing of quite a number of the meters then in use. A great many of the buildings in the city are so constructed as to make it impossible to attach the meters so that they will escape the frosts, however much care may be observed in locating them; and it is extremely difficult to decide in the warm season the most suitable place to prevent this difficulty. It was suggested that the Board, as far as is possible, furnish the Superintendent,

in the cold season, a list of buildings that they propose to meter, so that the warmest place may be selected.

The right of flowage at Lake Cochituate is predicated upon the location of Knight's Flume, so-called, both in the original deeds and in the subsequent Acts of the Legislature. This flume is a portion of the old mill which belonged to Mr. Knight, from whom the City purchased the property, and is situated within the Lake, and about thirty feet above the outlet-dam, in a southeasterly direction. The floor of the flume is always covered by water, and is liable to be carried away, or displaced by accident. In order to fix this important point permanently, the City Engineer, at the request of the Board, on the 22d of October, the water being then at a favorable stage, directed it to be dammed out, so as to expose to view the original plank composing the floor of the flume; and the point to which the City is allowed to raise the dam above said flume, by the act of the Legislature, April 5th, 1859, was permanently preserved by causing the centre stone abutment of the outlet-dam to be cut down to the exact high-water line, and the following inscription cut in the stone: "H. W., Apl. 5, 1859."

The following heights also we take from the Report of the City Engineer, Jan. 17th.

LAKE COCHITUATE.

Gate House Floor, $13\frac{74}{100}$ feet above the floor of Knight's Flume.
Interior bottom of Conduit $3\frac{36}{100}$ feet below " "

As compared with Tide Marsh Level.

| | |
|---|---|
| Floor of Knight's Flume . . . . . | $124\frac{36}{100}$. |
| Top of the Southerly Centre Pier of outlet-dam, . . | $134\frac{51}{100}$. |
| High water mark (inscribed on said pier), . . . . | $134\frac{36}{100}$. |
| Gate House Floor, . . . . . | $138\frac{10}{100}$. |
| Interior bottom of the Conduit, . . . . . | 121. |

DUDLEY POND.

High water mark, $22\frac{10}{100}$ above the floor of Knight's Flume.
Or $146\frac{46}{100}$ above Tide Marsh Level.

DUG POND.

High-water mark, 17 feet above the floor of Knight's Flume.
Or $141\frac{36}{100}$ above Tide Marsh Level.

The Boston Gas Light Company having petitioned to be paid as per bill rendered for damage to pipes, and changing the location of the same, on

account of raising the water pipes on Tremont Street, it was voted to submit the claim to the City Solicitor to ascertain if the city were liable therefor.

He gave his opinion, January 19th, that the city was in no way responsible; and the bill was returned to the Gas Company, with the statement that the City Solicitor had decided the city was not liable.

On December 23d of last year, (1865,) several questions were submitted to the City Engineer, in regard to the expediency of removing the Conduit from its present location through the proposed Reservoir at Chestnut Hill, and carrying it around the Lawrence Meadow; to which he replied, February 15th, (See Water Board Records, page 112,) giving his answer to the several questions submitted; and closed in the following words.

"The advantages of retaining the present location are: 1st, It is the most direct. 2nd, Being, in my opinion, equally safe with the other route, it is very much less expensive; and 3d, If the Board should coincide with me in the opinion that it is very desirable and important to separate this Reservoir into two parts, so that one may be drawn for repairs, or for any other purpose, without reducing the head, or losing any portion of the water in the other, it must be apparent that this separation or division can be made more economically in connection with the present route of the Conduit, by simply adding the expense of the proposed re-building of the conduit, widening of the bank, etc., to the cost of an effluent chamber to be located on the northerly side of the Bennett Meadow. Whereas, to accomplish this separation, if the Conduit were carried around would add $15,315.50 to the estimated cost thereof, and would increase the total cost of the Reservoir $36,900.35. (See Estimates, No. 2.) It therefore seems very important that, before instituting a comparison of the relative cost of the two routes, the question of the necessity or desirability of dividing the Reservoir should first be considered and determined.

"It should also be borne in mind, that the second advantage gained by going around the Lawrence Meadow, — the increased water capacity, — would be gained only by excavating and removing the present Aqueduct bank across the Bennett Meadow; and as this excavation would be surplus or waste, not required in embankment, the same advantage could be obtained at some other locality quite as cheaply.

"I have endeavored to give this subject a full and impartial consideration, and I hope the results of my investigations, as embodied in this communication and the accompanying plans, may be of service to the Board in arriving at a just and intelligent conclusion." He then gives his estimates in detail, making the difference between carrying the Conduit around the Lawrence

Meadow, including dividing the Reservoir in two parts, $36,900.35; or, if carried around but not divided, $21,584.85.

On February 16th, the above communication, with the accompanying plans, were considered by the Board, and it was decided by a yea and nay vote, "that the Conduit be continued in its present position, where it crosses the Chestnut Hill Reservoir, as nearly as practicable." Messrs. Norcross, Thorndike, Wadsworth, Standish and Dennie, voting in the affirmative, and Messrs. Fitch and Bradlee in the negative; and the latter requesting that their votes might be so recorded, as they did not believe it could be made perfectly secure in the manner proposed by the Engineer, and that it could be carried around at less expense than it would cost to thoroughly secure it in its present location.

Mr. Henry M. Wightman, who had been the City Engineer's Assistant, in making the survey at the Reservoir, was appointed Resident Engineer, February 14th; which office he accepted, and has since been constantly employed in laying out the work and perfecting the plans, under the direction of the City Engineer.

In 1858, when the Dover Street Bridge was rebuilt, a portion of the main pipe which supplies South Boston was replaced with new 20-inch pipes of *Scotch manufacture*, covered inside and out with a *bituminous coating*, designed to prevent rust and the formation of tubercular accretions on the inside of the pipes. March 6th, 1866, one of these pipes was opened in the presence of several members of the Board and the City Engineer, for examination, to ascertain the effect of the bituminous coating after the action of the water upon it for eight years. The result was highly satisfactory, the pipe being as free from rust as when it was first laid; and those present were of the opinion that in future all the pipes should be coated in like manner before being laid, as this was a simple and not very expensive remedy.

A thorough examination of the interior of the Conduit was made during the year in company with the Superintendent and members of the Board. The section from the Lake to Dedman's Brook waste-wier was found to be coated with the peculiar vegetable matter alluded to in former reports, and was thoroughly cleaned by the Superintendent.

Mr. Edward F. Knowlton, who was appointed Superintendent of the Reservoir, and who had been connected with the Water Works in various capacities from their commencement, died on March 12th. He had been unwell for some months, although he attended to his regular duties until within a few weeks of his death. His funeral took place on the 15th, and was attended

by the members of the present and past Water Boards, and a large number of friends.

At a meeting of the Board, held on the 30th, the following Resolve was unanimously adopted: "That, the death of Edward F. Knowlton, Superintendent of the Western Division of the Water Works, having taken place on the 12th inst., this Board desires to place on record their testimony to the faithful, upright and prompt manner in which he always performed the duties incumbent upon him; that we feel that the City of Boston has sustained a great loss in the decease of this valued officer, and that we deeply sympathize with the widow and son in their great bereavement."

The island on the westerly shore of the Lake, near the Superintendent's house, which was washing away, has been surrounded by a stone wall, and sodded, and is now a pleasant feature in the scenery of the Lake. As the work at this island was done at the suggestion and under the direction of the late worthy Superintendent, it was proposed that, in remembrance of him, it henceforth be known as *Knowlton's Island.*

The Board invited Mr. Albert Stanwood, the former Superintendent of the Eastern Division, to assume the duties of Superintendent of the new Reservoir. Mr. Stanwood, after consultation with the Board, accepted the position March 26th, and entered upon his duties.

On April 2d, the annual election of the Water Board for 1866–67, took place; when the following persons were chosen: —

Jonas Fitch, from the Board of Aldermen.

Alexander Wadsworth and Benjamin F. Stevens, from the Common Council.

L. Miles Standish and John H. Thorndike, citizens at large for two years.

Messrs. Otis Norcross and Nathaniel J. Bradlee's terms unexpired.

They met for organization April 2d, when Otis Norcross was re-elected President, S. N. Dyer, Clerk, E. R. Jones, Superintendent of the Eastern Division. The election of Superintendent of the Western Division, and of Assistant Clerk, was postponed. The same persons were appointed on the Committees on the Purchase of land, and the Construction of the new Reservoir, as last year, with the exception that Mr. Stevens was substituted for Mr. Dennie, whose term had expired.

May 21st, the Joint Standing Committee on Water who were directed April 30th to consider the expediency of abolishing the office of Water Registrar, and uniting the duties of that office with those performed by the Clerks of the City Treasurer, Reported, That they had consulted with the Water Board

and City Treasurer, and find that no change could be made whereby the duties of assessing the water rates, distributing the bills, inspecting the premises of water takers, and enforcing the regulations in relation to the use of water, would be performed in a more economical or satisfactory manner. It would form a separate branch of the Treasurer's office, with a chief clerk, and the same clerical force would be required to keep the records. The payments of water rates are now made to one of the Treasurer's clerks, which part of the business properly belongs to the Treasurer. The committee are, therefore, of opinion that it would be inexpedient to abolish the office of the Water Registrar. This Report was adopted. (City Records, 1866, p. 39.)

June 6th, 1866, the Water Ordinance was amended, so as to require that all bills for expenditures of the Water Board shall be drawn for by the President, examined by the Auditor, and approved by the Committee of Accounts before they are paid by the Treasurer; and "pay rolls" of clerks, inspectors and laborers in the Water Department, shall be made up under the direction of the Water Board, and certified by the President, and, upon being duly audited and allowed, be paid by the City Treasurer, at such times and places, and by such clerks as he may appoint. (City Ordinance Record, p. 305.)

June 8th, the Water Ordinance was amended, so that Steamboats should be charged upon the estimated quantity of water consumed, at such rates as may be determined by the Water Board, but in no case less than the rate charged for manufacturing purposes: provided, that no water shall be allowed for washing said steamboats, except by special permission from the Water Board, under a penalty of ten dollars. (City Ordinance Record, page 306.)

June 22d, the price of estimated water for boilers for steamboats was fixed by the Water Board at the rate of six cents per one hundred gallons. The price for washing purposes, when used through a hose with a nozzle one inch in diameter, was fixed at five dollars per hour; and through a five-eighth inch, or less, at four dollars per hour.

July 23d, 1866, the Water Board submitted their Annual Report, for the year 1865–66, in print, (City Document No. 61, for 1866.) Its interesting points will be found herein, under their respective dates.

September 27th, in conformity to an Order of the City Council, relative to a Drive way at Chestnut Hill Reservoir, the Water Board sent a Communication to the City Council on the subject, in which they state that finding it impossible to locate and make estimates for a variety of widths for a Drive-way around the Reservoir, prior to the meeting of the Common Council, they had made a plan and approximate estimates for one substantially eighty feet in

width; compromising that width in cases of fine shade trees, and of ledges which may add picturesqueness, and where the bank of the Reservoir requires it, but never to less than sixty feet. These widths are to be exclusive of the footpaths and grass plats. The road follows the rise and the descent of the ground, and, except where it passes through groves or around rocks, lies upon the margin of the Reservoir, or keeps the water in sight, thus avoiding monotony, and affording beautiful views for the whole distance.

They also state that there will be thus required a purchase of two or three acres of ground: and they suggest a separate appropriation for the cost of this road, and an annual one for the expense of maintaining and taking care of it; as a question might arise whether these expenditures would come under the assessments they are empowered to make for the cost of the Water Works.

The Engineer's estimate for this road, as per plan presented, was $117,485 (City Records, for 1866, p. 676.)

October 8th, an Order was passed authorizing the construction of the Driveway substantially in accordance with the Plan above mentioned, drawn by N. Henry Crafts, City Engineer, at an expense not exceeding $125,000, and that the City Treasurer be authorized, under the direction of the Committee on Finance, to borrow the sum necessary.

October 16th, the Committee on the Eastern Division reported with regard to laying pipes across the bridge over the Providence Railroad, at Berkley Street, Boston, a letter from the Engineer of said railroad to the President of the same, saying "the bridge was designed of sufficient strength for the ordinary use of a bridge, and I am unwilling to assume the responsibility of weighting it, with anything foreign to that purpose."

During the year 1866, considerable progress was made on the Chestnut Hill Reservoir. Temporary buildings were erected for the accommodation of a portion of the men to be employed upon the works, and stables for the horses and oxen. Contracts were also made with B. F. Ricker for furnishing teams; with Messrs. Learned and Shaw for boarding the men for one year, and with S. S. Rowe for laying slope walls. Most of the work, however, was done by the day, under the direction of Mr. Stanwood, superintendent; a large portion of it being the clearing of the grounds, the blasting of rocks, surveying, and getting the premises ready for active operations the following year.

The observations and experiments with regard to the supply and consumption, and the waste of water, reached some good conclusions. It was found that the system of inspection, instituted in 1864, proved of great use in checking waste; and though unwelcome to the improvident, the Inspector has

been cheerfully admitted as soon as the object was understood by the careful and well intentioned.

The supply of water for 1866 was nearly equal to the average supply of the five previous years, while the consumption, including waste, was nearly 4,000,000 gallons daily less than the average of those years: showing that the appeals made to the people had the effect to economize water; and it was only through this means that they had a constant and full supply during all the months of November, December, January, and February following.

## 1867.

January 15th, 1867, Otis Norcross having been elected Mayor, he resigned his position as President of the Board, and John H. Thorndike was chosen to fill the vacancy.

February 7th, 1867, William F. Davis was chosen Water Registrar.

February 14th, the members of the Cochituate Water Board for 1867–68, were elected as follows: —

Charles R. McLean, from the Board of Aldermen.

Nathaniel J. Bradlee and Alexander Wadsworth, from the citizens at large.

Benjamin F. Stevens and William S. Hills, from the Common Council.

The terms of John H. Thorndike and L. Miles Standish, unexpired.

February 9th, the following Letter was received by the Water Board from the "Commissioners on behalf of the City of Boston, upon the subject of annexing Roxbury to Boston:"

Boston, January 9th, 1867.

Hon. Otis Norcross,

President of the Cochituate Water Board, —

Dear Sir:—On behalf of the Commissioners on the part of the City of Boston, appointed to confer with the Commissioners on the part of the City of Roxbury, on the subject of annexing the two cities, I am directed to make some inquiries of the Board over which you preside. The Commissioners desire to be informed of all facts within your knowledge, on the supply of water, which have a tendency to show that the annexation of the two cities is or is not desirable.

We should be glad to have your opinion as to the sufficiency of the supply, in regard to the present and future wants of the two cities.

We desire an estimate of the probable expense which the introduction of water into Roxbury will entail upon the two cities, if united.

We shall be obliged for any information tending to show what increase in the amount and expense of the existing drainage in Roxbury, assuming it to be sufficient under existing circumstances, will be required if a proper supply of water be introduced into that city.

The familiarity of your Board with this subject makes it superfluous for us to be more specific in our immediate inquiries, but it will give me pleasure to wait upon you at any time which you may designate.

I am, very respectfully,

WM. GRAY, *Chairman of the Commissioners.*

To which the Board answered as follows:—

CITY OF BOSTON, CITY HALL,
COCHITUATE WATER BOARD OFFICE.
Feb. 18, 1867.

SIR, — In reply to your communication of the 9th ultimo, requesting to be informed of all the facts within our knowledge upon the supply of water, and of our opinion as to the sufficiency of the supply for the two cities, Boston and Roxbury; and also to be furnished with an estimate of the probable expense of the introduction of water into Roxbury if annexed, — we have to say, that to furnish you with answers as correct and as much in detail as would best satisfy ourselves, much more time for engineering and surveying would be required than you can well allow us, if your Report is to be acted upon by the Legislature now in session; and, therefore, with the assistance of our able City Engineer, we have made various estimates founded upon such data as were immediately available; and now present the same for your consideration:

| | | |
|---|---|---|
| The area of *Boston Proper* (not including streets) is about | 970 | acres |
| Of this there are built upon and improved about | 630 | " |
| Leaving of available unimproved land about | 340 | " |
| The filled area of *East Boston* (not including streets and squares) is about | 660 | " |
| Of this, there are built upon and improved about | 170 | " |
| Leaving of available unimproved land about | 490 | " |
| Besides this, there are of flats wholly unimproved | 440 | " |
| And of flats already enclosed | 103 | " |
| Making a total, ultimately available, of | 1,033 | " |
| The upland (304 acres) and marsh (416 acres) of Breed's Island, which will probably become a part of East Boston, amounts to about | 720 | " |
| The filled area of *South Boston* (not including streets and squares) is about | 675 | " |
| Of this, there are built upon and improved | 285 | " |
| Leaving of available unimproved land | 390 | " |
| The area of the flats on the northerly shore, which may be added, is about | 600 | " |

| | |
|---|---|
| The area of *Roxbury* (not including streets and squares) is about | 2,184 acres |
| Of this, there are built upon or improved . . . . . | 684 " |
| Leaving of available unimproved land about . . . . . | 1,500 " |

The foregoing estimate of the area built upon is, of course, very rough; for in cases where, to a single house, there appears upon the map to be several acres, there has been allowed to such isolated house a half acre as improved land, calling the balance unimproved.

| | |
|---|---|
| Beside the above . . . . . | 1,500 acres |
| there are, of marsh land or flats, to be improved, . . . | 300 " |
| | " |
| making a total of . . . . . | 1,800 " |

The population of Boston in 1865 was 192,324, and the rate of increase from 1855 to 1865 was $19\frac{138}{1000}$ per cent. At the same rate of increase, the present population of Boston is about 200,000.

When the whole territory within the present limits of Boston is peopled as densely as the portions now built upon, our population will amount to nearly 600,000.

The present population of Roxbury is said to be about 30,000, and the rate of increase for the ten years from 1855 to 1865 was nearly 54 per cent; and, upon the same basis that Boston can accommodate 600,000, Roxbury can accommodate about 400,000.

Lake Cochituate, with all its tributaries, has not the capacity to furnish a constant supply of over 16,000,000 gallons daily. By gauging the lake in 1834, Loammi Baldwin estimated the supply at 16,156,800 gallons per day. It is true, that since raising the Outlet Dam in 1859, we have averaged a daily waste of 4,000,000 gallons; but we know of no practicable way to save this, as it occurs only when our ponds are already full. Should reservoirs be built to retain such a quantity, this extra supply would occasionally fail us, as in the case of 1864, when the water in the lake was drawn to within four feet and ten inches of the bottom of the Conduit, and the net quantity received into the lake actually available was only 11,620,000 gallons per day for that year. In 1860, there was no water wasted at the Outlet Dam, and in 1862, only 33,200,000, gallons were there wasted, being equal to about two days' supply to the city.

The present Conduit, when put in good repair, can safely convey only 18,000,000 gallons per day.

Assuming the capacity of the lake to be 16,000,000 gallons per day, and the rate of consumption for domestic use, manufacturing and all other purposes, at sixty-three gallons per inhabitant, the lake can supply a population of 254,000; and, at the present rate of increase, Boston will attain that population in fourteen years. If Roxbury should be furnished from our works, and the present rate of increase in her population continue, the limit of our water supply would be reached in a little less than five years.

Under these circumstances and conditions, we are very positive in the opinion, that if any material increase to our present stock of water is needed, we must seek an additional source, and convey it to the city by an entirely independent Conduit.

The Jamaica Pond Aqueduct Company, we are informed, supply a population in Roxbury of about 5,000, besides the breweries and manufactories; and a liberal estimate of the capacity of their pond, as now used, is about 400,000 gallons per day: but as the pipes laid by the company are inadequate in strength to bear the Cochituate pressure, we have, in making the estimate for the distribution of water in Roxbury, disregarded this supply and the present means of distributing it.

The estimated cost of a suitable Reservoir and of distributing the Cochituate water in all that portion of Roxbury (excepting the marsh and flats of the Back Bay north of Ward Street and west of the Providence Railroad,) lying north of a line drawn from the junction of Grove Hall Avenue and Moreland Street, crossing Warren Street at Clifford; Walnut Street at Otis; through Otis to Shawmut Avenue; from Shawmut Avenue through Marcella and Highland streets to Center Street; through Center and Lowell streets to Washington Street, and through Washington Street to the line between Roxbury and Brookline, is $650,000.

Where from, and in what manner, to obtain a further supply of water is a problem not easy to solve. It can only be solved by extensive surveys and skilful engineering, requiring months to execute; and what might be the result is at this present time so obscure, that the Board are disinclined to make even a suggestion in regard to it.

So far as the supply of water may affect your decision as to the feasibility of annexing Roxbury to Boston, we presume that the foregoing facts and estimates will not add to any reasons you may have for favoring it.

Very respectfully,

JOHN H. THORNDIKE,

*Prest. Cochituate Water Board.*

HON. WILLIAM GRAY,

*Chairman of the Commissioners on the part of the City of Boston, upon the subject of annexing Roxbury to Boston.*

April 1st, 1867, the Board met for organization. John H. Thorndike was re-elected President, Samuel N. Dyer was chosen Clerk, Albert Stanwood, Superintendent of the Western Division, and Ezekiel R. Jones, Superintendent of the Eastern Division.

April 5th, it was voted, That the President be authorized to commence the collection of "*Books relating to Water Works,*" with a view to forming a LIBRARY FOR THE WATER BOARD.

April 5th, Messrs. Thorndike, Standish & Bradlee were chosen a Committee on the Construction of the Reservoir.

May 14th, the Committee on Eastern Division reported on the strength of different sorts of pipes, according to the tests which they had applied:

*Tests of Pipe.*

1st — 5-8-inch lead pipe, $2\frac{3}{4}$ lbs. per foot, same as now used by the City, burst at a pressure of 1,050 lbs.

2d — 5-8-inch lead pipe, lined with tin, $1\frac{9}{16}$ lbs. per foot, burst at a pressure of 1,450 lbs.

3d — 5-8-inch block tin, burst at a pressure of 1,500 lbs.

4th — 1-2-inch lead, 2 lbs. per foot, burst at a pressure of 1,450 lbs.

5th — 1-2-inch lead, lined with tin, $1\frac{2}{16}$ lbs. per foot, burst at a pressure of 1,200 lbs.

*Second Trial.*

6th — 3-4-inch lead pipe, 4 lbs. per foot, burst at a pressure of 1,025 lbs.

7th — 3-4-inch lead pipe, lined with tin, 2 lbs. to a foot, burst at a pressure of 1,100 lbs.

May 11th, the proposal of Gardner Brewer to give to the City, and place on Boston Common, a duplicate of the Fountain in front of the Hotel de Ville at Lyons, France, with an appropriate basin, was accepted with thanks; and it was ordered by the City Government, that it be located in such portion of those grounds as the Mayor and the Committee on the Common may deem the most appropriate to enable the Fountain to display to the best advantage its exquisite proportions, and to fulfil the use for which it is especially adapted.

The 21st of May, 1867, the Water Board made their Annual Report, for 1866–67. (City Document 88.)

This Report is interesting and important as a continued record of the actual operations of the Water Works; of the progress of the additions necessary to complete them; of the meteorological conditions that affect the supply of water; and also as a seasonable notification that an increase of the resources of that supply will be required for the wants of any population which may be annexed to the City.

Their adoption of the financial year of the City ending April 30th, remedied former apparent discrepancies between the accounts of the Board and those of the City Treasurer and Auditor; and the Board suggest that all the Water Bills should be made to conform to a like calculation.

This year an iron bridge was erected, outside of the travelled bridge so as

to avoid any jar, to carry the two large Mains over the railroad at Tremont Street; and the Main was moved during the winter, under great difficulties, arising from the nature of the foundation, and the weather. It is proposed to cover this bridge with an iron roof to protect the pipes from the sun.

In 1866, Mr. A. Stanwood, the Superintendent at Chestnut Hill Reservoir, was chosen Superintendent of the Western Division, in the charge of which he had assisted the Chairman of the Committee on that Division, since the death of Mr. Knowlton.

On the 9th and 10th of February, 1867, occurred the greatest freshet known in the vicinity for years. A heavy rain, with the melting snow, raised the lake from thirteen feet to thirteen feet five inches, or one inch more than full; and that amount ran to waste over the dam. On all such occasions of high water, the stop planks of the dam are removed, to save the banks of the lake.

On the 27th July, in a shower of a few hours, there fell, in the vicinity of the lake, the unprecedented quantity of 7.6 inches of rain; the level of the lake was carried up in twenty-four hours, eight inches, and a small part of the Filter Dam, on Pegan Brook, was washed away. The slope wall in various places, where too steep, was undermined, and slid into the lake.

The experience of the year 1866–67, proved a decrease of thirty-nine per cent. in the daily consumption of water, as compared with that of 1861.

The records of the meters in the houses of the members of the Board showed during the above time, that for all domestic uses, twenty-five gallons of water per inhabitant is an ample daily supply. The amount consumed by the large manufacturers in the year was 2,000,000 gallons per day, and estimated miscellaneous consumption, 1,000,000 gallons per day: population say 200,000. An increase of meters, more rigid inspection, and a tax on hopper closets, were recommended.

Upon examination of the *Conduit*, there were found no cracks in the first division, and in the second about nine, of which two were serious; and only a single section, between two stations, needed cleaning

At this examination, a trial was made of the *Magnesium Light*, for illuminating the interior, and with the exception of certain slight mechanical defects in the apparatus, it was a decided success, and a vast improvement upon the ordinary lights hitherto used.

July 16th, the following Order was passed by the City:

"Whereas, in the opinion of the City Council, the health and convenience of the inhabitants require that DRINKING FOUNTAINS should be established in different sections of the City,

"*Ordered*, That the Cochituate Water Board be requested, in consultation with the Joint Committee of the City Council on Water, to establish a number of Drinking Fountains, not exceeding six, in different sections of the City, and that the expense thereof be charged to incidental expenses." The Water Board ordered from New York a new style of Drinking Fountain, which was generally approved; but no further action was taken upon the subject this year.

September 28th, the Board, under authority, purchased of the Catholic Bishop about $2\frac{3}{10}$ acres of land in Natick, between Dug Pond and the neighboring Cemetery.

About $16\frac{3}{4}$ acres of land in Natick, bordering on Dug Pond, were purchased in addition to that mentioned above.

During the year, several petitions for laying Mains and other pipes were granted upon the condition of petitioners paying the cost of the same. And from time to time, at the request of the Board, the Registrar officially recommended the attaching meters to certain buildings.

## CHESTNUT HILL RESERVOIR.

The work upon this Reservoir was carried on successfully during the year 1866–67. From the middle of November to the middle of April, muck was removed; ledges blasted, and a retaining wall for the drive-way constructed. An engine and pump were used to keep the trenches free of water; on the 27th August, 1866, during the absence at dinner of the engineman, the boiler exploded.

The Report of the City Engineer states that, at an examination, it was concluded that the water was carelessly left too low by the engineman, who therefore was promptly dismissed.

Through the year 1867–8, the work was continued with great vigor. Contracts were made with Messrs. Broad & Ward, for granite capping for the slope walls; with Hugh McGinness and others, for puddling clay; with O. T. Rogers & Co., for the hammered granite for the intermediate Gate House; and with S. S. Rowe, for boarding the men.

There were laid during the year over seven thousand feet of brick drain in cement, on the south and west side of the Reservoir, varying in size from six feet four inches to two feet six inches in diameter, requiring over one million brick in its construction.

March 2d, over two hundred of the laborers struck for higher wages, and notice was at once given, that none of those who left the work would be

taken back again; the delay was but temporary, as their places were all filled within three days.

For the better finishing of the drive-way, one of Blake's stone-breakers was purchased, and was found to be of great service.

The progress having been so successful thus far, it is fair to presume that it will require but one year more to complete this Reservoir for use, and that the water can be let into it in the Spring of 1869.

# PART FOURTH.

DESCRIPTION OF THE COCHITUATE WATER WORKS,

TO

THE FIRST OF JANUARY, 1868.

# CHAPTER XXII.

Changes made since the introduction of the Water — Lake Cochituate; its situation and size — The Dams and their positions — The Gate House; its position and size — Marginal Lands — Dug or Monsemog Pond; its position, size, and connection with the Lake — Dudley Pond; its position, size, and connection with the Lake — Division of the Works — Brick Conduit; its location, size, shape and division; its grade and length — Mains over Charles River Valley; their number, size and length — The Tunnels; their position and length — The Waste Weirs; their positions and size — Ventilator: its position and size — Man-holes — Culverts and Drains — Tablets.

THE Cochituate Water Board of 1851, in their Annual Report, gave a full description of the works as then completed, from which our accounts have been compiled, with such omissions, alterations and additions as were made necessary by the changes that have since taken place.

The most important of these changes have been, the raising of the Gate House and Dam at the Lake; building of a new Dam; connection of Dudley Pond with the Lake; laying of the third pipe across Charles River from the east to the west pipe chamber; rebuilding the west pipe chamber in a new position; laying of the 40-inch main from the Brookline Reservoir into the City over the Mill-dam road; sale of the Compensating Reservoirs in Hopkinton and Marlborough; sale of the property of the Jamaica Pond Aqueduct Company; and building the Chestnut Hill Reservoir.

## LAKE COCHITUATE.

Lake Cochituate, formerly known as Long Pond, the main source from which the supply of water for the city is taken, is situated within the limits of the towns of Framingham, Wayland, and Natick, in the county of Middlesex.

It may be considered a chain of natural, subsiding Reservoirs of water, three in number, having a general direction nearly north and south; its extreme length in a direct line being about three and one-half miles, and its greatest breadth about eighteen hundred feet.

The Lake is crossed by the Boston and Worcester, now Boston and Albany, and the Saxonville Railroads; and by three county roads, one of which is the road leading from Natick to Framingham, another was formerly the Worcester turnpike, and the third is a road leading from Framingham to Newton. As the last two county roads indicate the natural divisions of the Lake, and separate it into three nearly equal parts, it is, for matter of reference, found convenient to consider the lake as divided by them, into the Northern, Central and Southern Divisions.

The water gradually increases in depth from the shore, in each division; at high water, or when raised ten feet above the flume, or thirteen feet and thirty-six one-hundredths above the bottom of the conduit, its greatest depth is about seventy-two feet in the Southern, fifty feet in the Centre, and sixty-four feet in the Northern Division. When the water is at this elevation, the superficial area of the Lake is estimated to be eight hundred acres.

For the capacity of the Lake at different levels, see Table No. III. in the Appendix.

The shore of the Lake is generally a bold sand and gravel bank, and the increase of surface which is produced by raising the water takes place mostly in a great meadow in the Southern Division, south of the Boston and Worcester Railroad; also, on another meadow at the southerly end of the same Division; on some low grounds near the northerly end of the Central Division, at the mouth of Snake brook; and lastly, in some small bays which occur in other places. When the water is raised eight feet above the flume, there are one hundred and twenty-five acres not covered with more than five feet depth of water; at six and five-tenths feet above the flume, there are one hundred acres covered with a depth of water not exceeding five feet; at three feet above, the peat meadow in the Southern Division is to a great extent covered: but the other meadows in the same Division, and that in the Central, are mostly bare. The whole circuit of the Lake, including the meadows, is about sixteen miles; and excluding those, about twelve miles, measured at the verge of the Lake, when the water is eight feet above the flume.

The tract of country which drains into the Lake is bounded by the ranges of hills which divide the streams running into the Merrimack from those which run into Charles River, and, as surveyed, covers an area of 12,077 acres, including the Lake. Deducting from this amount 677 acres as the area of several ponds included in it, which are estimated to lose by evaporation from their surfaces a large proportion of the rain which falls upon them, there remain 11,400 acres or 496,584,000 square feet, as the water-shed from which the Lake derives its supply.

NOTE.

Height of Floor of Gate House 138.10
Height of Floor of Knights Flume 124.36
feet above Tide Marsh Level.
Height of Low Water Mark Lake Cochituate
124.86 feet above Tide Marsh Level.
Height of High Water Mark Lake Cochituate
134.36 feet above Tide Marsh Level
Height of Bottom of Interior of Aqueduct
at Lake Cochituate 12100 feet above Tide
Marsh Level.
Area of Lake Cochituate not including
Dug or Dudley Ponds about 800 Acres
Whole Circuit of Lake Cochituate 16 Miles

At the time of the passage of the Act, 1846, as has been before stated, these waters of the Lake were in the possession of Mr. William H. Knight, who owned the outlet and had several mill privileges and manufacturing establishments connected with it between the Lake and Sudbury River into which it naturally discharges its waters. All Mr. Knight's interest was accordingly purchased and vested in the city, and the city thereby acquired the right of exclusive use of the water, and of diverting it from its natural channel; subject, however, to any damages which might be sustained, by proprietors of water rights situated below Mr. Knight, by reason of the diminution of their supply of water.

The SUDBURY RIVER joins the *Assabet* about fourteen miles below Mr. Knight's mill privilege, and the two form the CONCORD RIVER, which, after flowing through an almost perfectly level country about ten miles to BILLERICA, thence continues on about four and a half miles, and finally empties into the MERRIMACK at LOWELL. All the water of CONCORD RIVER, including that from the Lake, was subject to the use of the MIDDLESEX CANAL, in the first instance to supply the canal; and the surplus belonged to the proprietors of the mills at Billerica, and to those of three other privileges on Concord river.

The original Act gave authority to raise the Lake to eight feet above the floor of Knight's Flume, which at that time was deemed sufficient to store the excess of water which would collect during the winter and spring, for use during those months which have proved to be the season of a low state of water in the streams. This, however, was found insufficient, and an additional Act was passed in 1859, giving authority to raise the dam at the outlet to ten feet above the floor of Knight's Flume, which latter is 3.36 feet above the bottom of the conduit. (See Part III., Chapter 19.)

## DAMS.

The First Dam was constructed at the outlet, on the west side of the northern division, in the town of Framingham. It is of solid masonry, of granite, and raised to a height sufficient to retain the water to a point ten feet above the floor of the flume. This corresponds with an elevation of 134.36 feet above tide marsh level; the floor of the flume being 124.36 feet above the same level.

The Second Dam was built in the year 1857, at a distance of about five hundred feet below the first, for the purpose of lessening the pressure upon the upper dam; and is also of solid masonry, with an overflow of twenty-three feet in width.

### Gate house at the lake.

This Gate House is situated on the eastern side of the *Northern Division*, in the town of Wayland, opposite to the dam, and is built a sufficient distance into the lake to admit the water from the necessary depth. The bottom of the Aqueduct, which here commences, is placed at an elevation of three and thirty-six one-hundredths feet below the floor of the flume. When the lake is raised to the high-water mark, it will stand thirteen and thirty-six one-hundredths feet above the bottom of the Conduit.

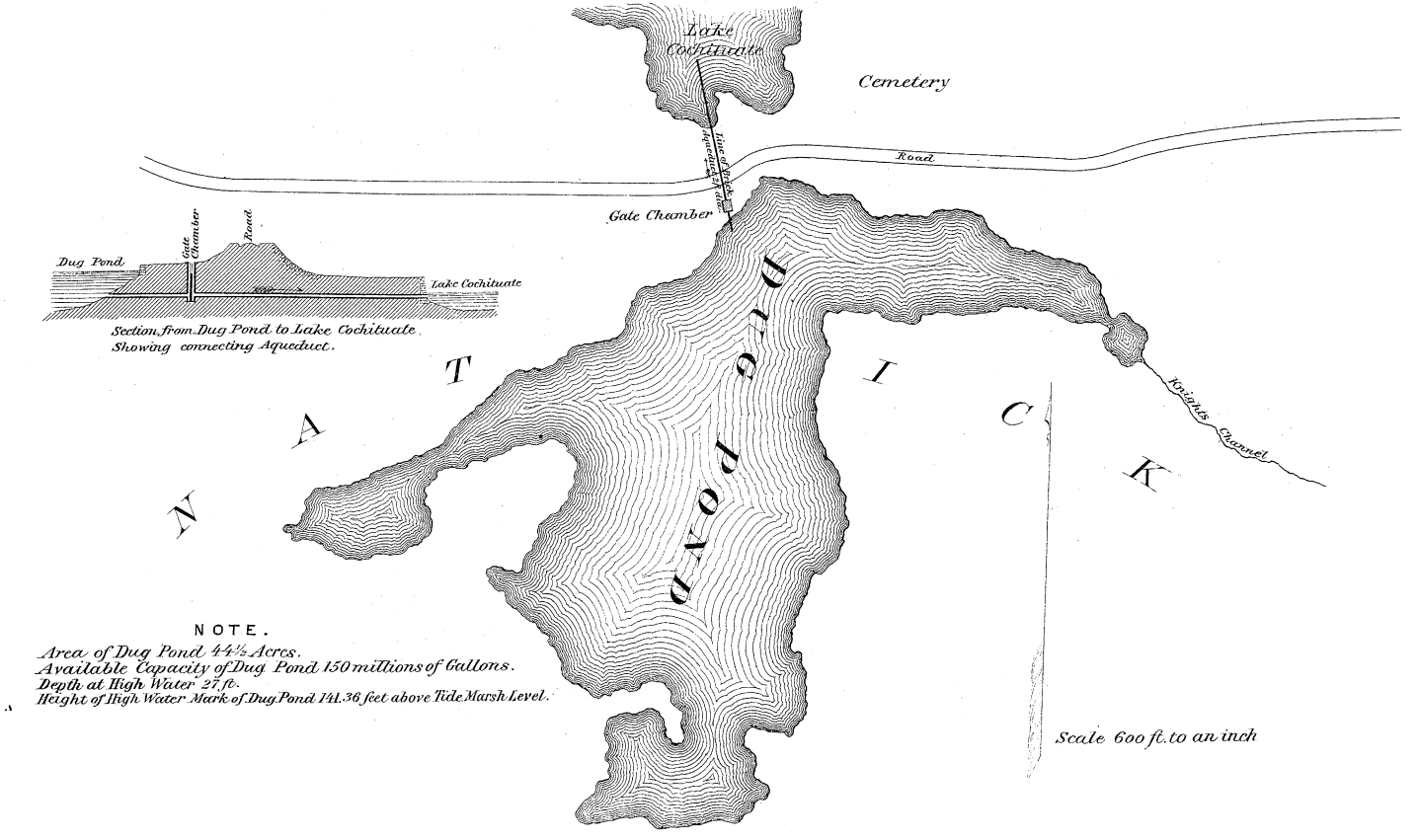
In the house, there are four gates for regulating the admission of water into the Aqueduct. They are of cast-iron, with composition or gun-metal facings, and a frame of the same materials, set in hammered stone; and are worked by composition screws in composition nuts.

This building is twenty-nine feet six inches by thirty-nine feet six inches, of hammered granite, with a metal roof, secured effectually from intrusion. The floor is of granite, and there are two flights of granite steps from the floor down to the Conduit.

A stone Culvert is also constructed beneath the road, which divides the Northern from the Central Division, in which provision has been made for placing stop planks, so that the water can be shut off from the Northern Division; and thereby about two-thirds of the water in the Lake can be retained, in case it should be necessary to repair the gate house or dams.

### Marginal Lands.

To enable the city to exercise a proper control over the waters of the Lake, and for the purpose of preventing any acts which might tend to impair their purity, as well as for regulating the right to overflow the adjoining lands, it was authorized by the Act to take and hold a strip of land, not exceeding five rods in width on the margin of the Lake. It was soon ascertained, however, that in cases where land was to be taken for these purposes, or for the construction of the Aqueduct, or Reservoirs, where material injury would be occasioned to the adjoining lands, it would, in many instances, be the most advantageous mode of adjusting the damages, to purchase the entire lot of land so injured, and to make re-sale of such part thereof, as might be deemed advisable, after the work should be completed. That system was accordingly adopted, and in consequence, the marginal lands thus purchased are of very different widths, according to the surface of the ground and the terms which could be made with the proprietors. The whole area purchased around the margin or immediately adjoining, was *six hundred and thirty-five and one-half*


Lake Cochituate
Cemetery
Line of Aqueduct
Road
Gate Chamber
Dug Pond
Gate Chamber
Road
Lake Cochituate
Section from Dug Pond to Lake Cochituate
Showing connecting Aqueduct.
N A T I C K
Dug Pond
Knights Channel
NOTE.
Area of Dug Pond 44½ Acres.
Available Capacity of Dug Pond 150 millions of Gallons.
Depth at High Water 27 ft.
Height of High Water Mark of Dug Pond 141.36 feet above Tide Marsh Level.
Scale 600 ft. to an inch

*acres*, and of this the city had the fee simple. It completed the entire circuit of the Lake, with the exception of a piece on the western side of the southern Division, about 2,200 feet in length, five rods in width, and containing about *seven and one-half acres*, which the city, being unable to purchase, took and now holds possession of, under the power given in the Act.

To the above quantity being added the amount purchased of Mr. Knight and others, in connection with the outlet and mill privileges, which was about *thirty-nine* acres, it appears that the whole area purchased and taken in the neighborhood of the Lake and outlet was *six hundred and thirty-five and a half acres* nearly, all of which, with the exception of the five rods in width on the margin of the Lake, has been sold.

## Dug or Monsemog Pond.

In addition to the supply of water contained in the Lake, Mr. Knight also conveyed to the city, that of Dug or Monsemog Pond, lying to the south of it.

The pond is about one hundred and thirteen feet from the southern shore of the Lake, and separated from the peat meadow, on the Southern Division, by the county road; a culvert, two feet in diameter is laid beneath the road, by which the waters are discharged into the meadow, and thence pass into the Lake. It contains about forty-four and one-half acres. The shore all around is a steep gravelly bank, eight or ten feet high, and the pond naturally derives its water wholly from springs. The city has also acquired a right to divert the waters of a brook on the east side into it, and thereby insure the filling up of the pond every winter.

The water is quite deep, and remarkably pure and soft, and forms a highly important tributary to the Lake.

High-water mark in this Pond is seventeen feet above Knight's Flume; or one foot nine inches below the gate house floor, and one hundred and forty-one and thirty-six one-hundredths above tide marsh level.

## Dudley Pond.

The City also purchased the outlet to Dudley Pond, containing *one acre and thirty rods*, and took possession of its waters. This pond lies in a north-eastern direction from the Northern Division of the lake, and contains eighty-one acres, at an elevation of about twelve feet above it. The water is very pure and soft, and there is no other outlet than that owned by the City, through which it flows into Sudbury River.

This pond was connected with the Lake in the year 1861, thirteen years after

the introduction of the water into the City, by means of iron pipes eighteen inches in diameter and about eight hundred feet long, which pass under the road leading from Wayland to Newton: in making this connection, it was necessary to cut through an embankment sixty feet high, as the nature of the soil prevented its being tunnelled. The land between this pond and the City's land on the margin of the Lake was taken possession of under the Act, but was subsequently purchased.

High-water mark in this Pond is twenty-two feet and ten one-hundredths above Knight's Flume, or six inches below the top of the gate house floor, and one hundred and forty-six feet and forty-six one-hundredths above tide marsh level.

### The Aqueduct.

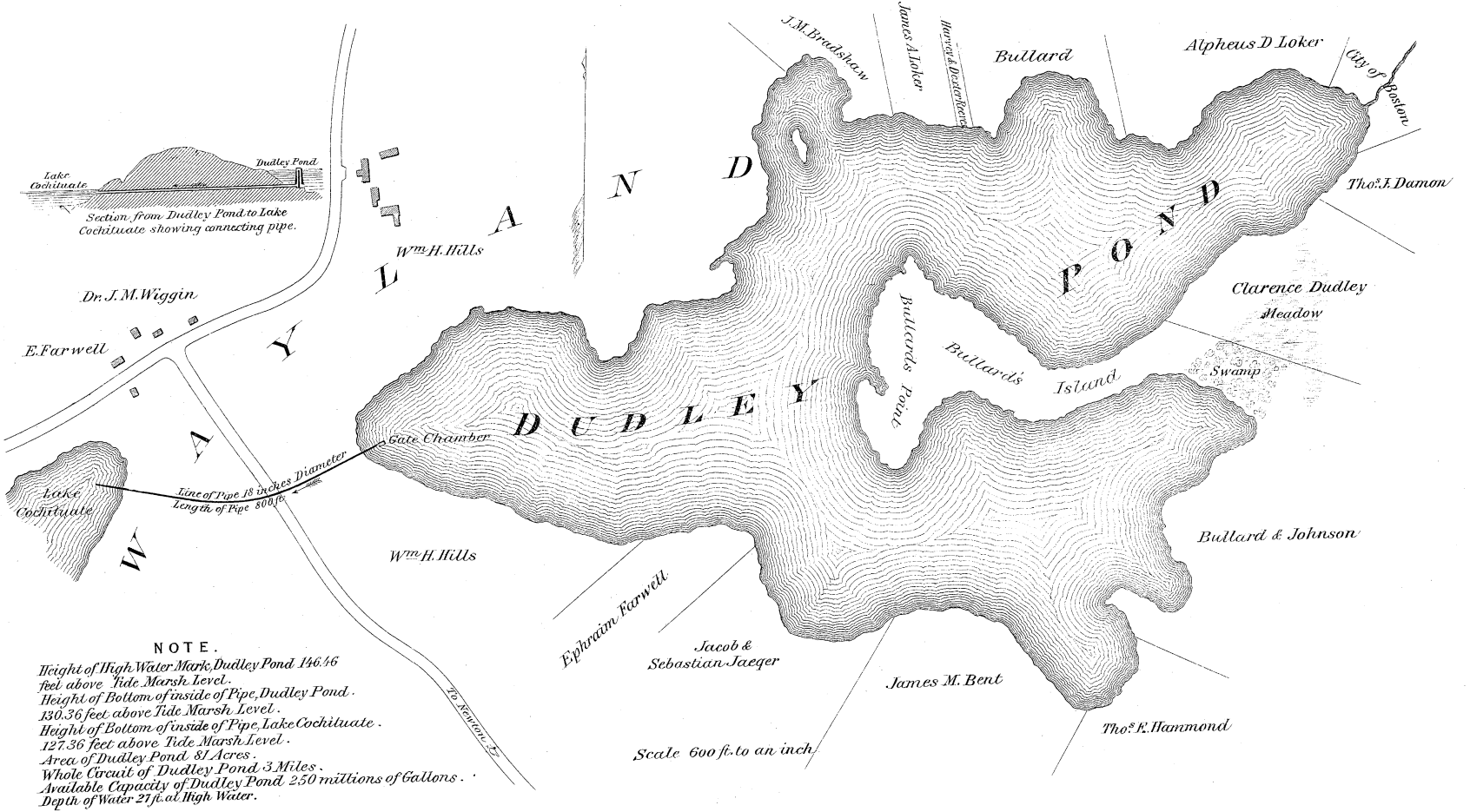
The Aqueduct, for convenience in its management, is divided into two divisions, the Western and Eastern. The Western extends from the Lake to and including the Receiving Reservoir in Brookline. The Eastern commences at the Brookline Reservoir, and comprises all the iron mains from Brookline to the City, and the Distribution in the City.

### The Brick Conduit.

The course of the Brick Conduit is accommodated to the elevation of the different parts of the line, by winding in a series of irregular curves; care being taken, where it was possible, to adopt such a route as would permit its being buried entirely beneath the natural surface of the ground.

Its general direction after leaving the Lake is southeasterly for about four and one-half miles, to near the village of West Needham. It then turns and runs northeasterly about two miles. Thence easterly, crossing Charles River, about three and one quarter miles. Thence northeasterly through the *long* Tunnel, about two and one half miles to the Ventilator. Thence southeasterly about two and one quarter miles, through the *short* Tunnel, to the Receiving Reservoir at Brookline; passing through parts of the towns of Wayland, Natick, Needham, Newton, Brighton, and Brookline.

The Conduit, from the Lake to the left bank of Charles River, and from the right bank of the same to Brookline Reservoir, is built of brick masonry, eight inches thick, laid in hydraulic cement. It is, in section, an egg-shaped oval, the largest end down; the greatest width is five feet, and the extreme height six feet four inches in the interior. It is covered with a plastering of hydraulic cement on the outside, from the top down to the chord line of the lower or inverted arch, more effectually to prevent the percolation of surface




NOTE.

Height of High Water Mark, Dudley Pond 146.46 feet above Tide Marsh Level.
Height of Bottom of inside of Pipe, Dudley Pond. 130.36 feet above Tide Marsh Level.
Height of Bottom of inside of Pipe, Lake Cochituate. 127.36 feet above Tide Marsh Level.
Area of Dudley Pond 81 Acres.
Whole Circuit of Dudley Pond 3 Miles.
Available Capacity of Dudley Pond 250 millions of Gallons.
Depth of Water 27 ft. at High Water.

water into it. It is supported on a puddled embankment, built up above the chord line of the inverted arch, in all cases where the Aqueduct passes over ground the level of which falls below the grade line, and also where the ground was found to be marshy, or from any cause not sufficiently solid to support the superstructure. In the latter case, the mud and loose soil were previously removed until a firm bearing could be had. The whole is covered with an embankment eight feet wide on the top, with side slopes of two feet horizontal to one foot vertical, and raised four feet above the top of the Aqueduct. The Aqueduct through the whole distance thus rests upon, and is covered with earth to a depth of at least four feet, and it is nowhere raised, so as to admit a passage beneath it, excepting at the culverts, — at the crossing of Charles River, which it passes by three iron pipes, two of thirty inch, and one of thirty-six inch diameter, — and where it crosses a valley in Needham, near the west bank of the river. In the latter place, it is carried over the roadway by a granite bridge, of one arch of twenty feet span, and fourteen feet high, and from there to the west pipe-chamber on a puddled embankment, in some places forty feet high.

In preparing the foundation and laying the reversed arch of the Conduit, much delay was occasioned, and additional labor required in the 2d, 5th, 10th, and some other Sections, on account of the large quantities of water, and in some cases quicksands, which were found near the bottom of the cut.

The Conduit, from the Lake to the Brookline gate house, is divided into Three Divisions; the first being 29,800 feet in length; the second, 26,400 feet; and the third, 23,000 feet; and these divisions are subdivided into Sections; the first comprising sections 1, 2, 3, 4; the second, 5, 6, 7, 8, 9; the third, 10, 11, 12, 13, 14, 15.

The whole line is divided on the inside by stations of one hundred feet each, which are marked by metallic figures placed on the sides, about five feet above the bottom of the Conduit, and the large Plans of the Conduit being marked in like manner, makes it an easy matter to fix upon the exact locality above ground.

The Conduit, for the greater portion of its length, is laid entirely beneath the natural surface of the ground, appearing above only for short distances at irregular intervals. The greatest depth of any part is at the Tunnels in Newton and Brookline, at the former of which, the bottom is about eighty feet; and at the latter, about sixty feet below the surface.

The deepest excavations made for it, were; — at a short distance from the Gate House at the Lake, near the waste weir at Dedman's Brook; near the waste weir in East Needham; and near the cold spring in Section nine,

in Newton. It was laid at those places about thirty feet deep. The longest interval that it remains beneath the surface entirely is from its junction with the Lake, for a distance of about two and a half miles. The bottom of the Aqueduct is not raised above the level of the natural surface of the ground for more than three-fourths of a mile through its whole extent.

The rate of Descent in the brick portion is three and one-sixth inches per mile. The Fall for the whole distance, including the Pipe Section over the valley of Charles River, is nearly three and one-half inches per mile.

The whole descent or fall is 3.81 feet in the brick Conduit, which is 14.307 miles long. In the Pipe Section, 1,095 feet long, it is 0.45 feet, making in the whole distance, 14.627 miles, a descent of 4.26 feet.

The whole quantity of land originally purchased and taken possession of by the City along the line of the Aqueduct, from the Lake to Brookline Reservoir, was three hundred and five acres and eight rods; the City has the fee in two hundred and seventy-six acres and ninety-five rods; and holds, by possession, taken under the Act, twenty-eight acres and seventy-three rods.

There have been several small lots purchased since, and several acres have been sold.

The first brick of the Aqueduct was laid October 19th, 1846.

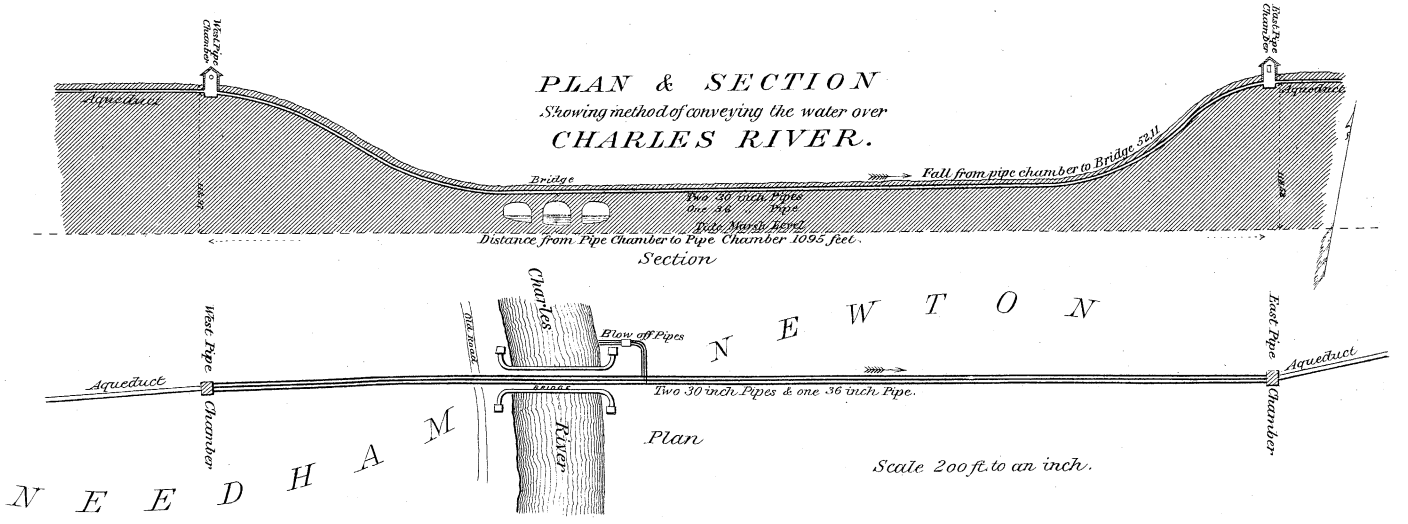
The bottom was all united September 17th, 1848, and Water let in October 12th, 1848.

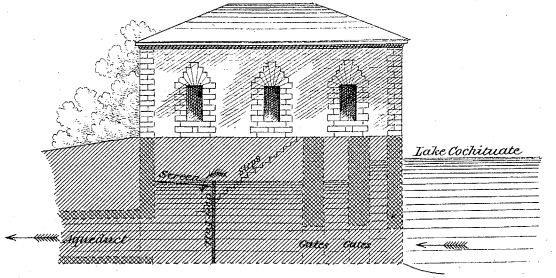
## The Mains over Charles River, Pipe Chambers and Charles River Bridge.

The remainder of this part of the Aqueduct comprises the Mains over the valley of Charles River and the Tunnels in Brookline and Newton. The former consist of three iron pipes, two of thirty inches in diameter, and one of thirty-six inches, which descend 52.11 feet below the level of the Aqueduct on the west bank of the river, crossing on a stone bridge built over the river; and thence are continued over the intervale at a rather lower level, and then rise to the Aqueduct on the eastern side.

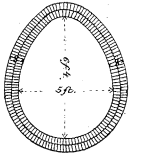
The Charles River Bridge is constructed of hammered granite, of three elliptical arches, of thirty feet span and seven and one-half feet rise, and twenty-one feet width. The horizontal distance between their termini is 1,095 feet.

The Pipe Chambers, constructed at each end of the Mains, are of granite, with iron doors and stone roofs; their size is seventeen feet six inches by fifteen feet. The admission of water is regulated by stop-planks.

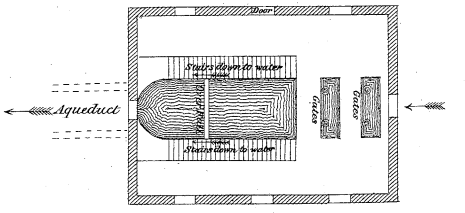



Elevation and Half Section of Gate House at Lake Cochituate.




Section of Brick Aqueduct.




Plan of Gate House at Lake Cochituate.

The bottom of the west pipe chamber is 118.97 feet above tide level.

The bottom of the east pipe chamber is 118.58 above tide level.

The water in the river at its lowest state is seventy-one feet below the bottom of the brick Conduit.

## The Tunnels.

There are two Tunnels excavated through porphyritic rock, of extreme hardness, in the towns of Newton and Brookline respectively. The former is *twenty-four hundred and ten feet*, and the latter, *eleven hundred and fifty feet*, in length.

A course of concrete is laid in the Tunnels, of variable thickness, to form a bottom of uniform inclination, coinciding with the level of the Aqueduct. Those portions which showed signs of perishable rock were lined with brick masonry; and brick arches of extra thickness were turned over the water course at all the shafts which had been sunk during the progress of the excavation, for the purpose of supporting the filling of earth which was put into them.

In the Newton Tunnel, the shafts were commenced at the west end, about November 15th, 1846.

The first drift was commenced at the west end, December 30th, 1846.

The last drift was completed April 28th, 1848.

The brick lining was completed August 27th, 1848.

In the Brookline Tunnel, the shafts were commenced December 17th, 1846.

The first drift was commenced about January 30th, 1847.

The last drift was completed June 20th, 1848.

The brick lining was completed August 30th, 1848.

## The Waste Weirs.

There are four Waste Weirs constructed for the purpose of letting off the water, and also for ventilation. They are built entirely of stone, with iron doors and stone roofs; the walls being carried up to a sufficient height to form an inclosure over the works. The overfall or weir is of stone, through the breast of which, two gates are fixed to draw the water off when required. The gates and gate frames are of composition metal set in cut stone, the gates being worked by composition screws in composition nuts.

The First Waste Weir in Section No. 3, is eight by fourteen feet, and situated at Dedman's Brook, about three miles distant from the gate house at the Lake. The level of the ground, is such that this is the nearest point where the water could be discharged.

The SECOND is of the same size, and situated at the end of Section No. 5; about one mile west of Charles River, in East Needham. The THIRD, also of the same size, is situated in Section No. 10, at the outlet of Baptist Pond, in Newton Centre, about three miles east of Charles River. And the FOURTH, which is nine feet by fifteen feet five inches, is situated in Section No. 13, in Brookline, about a mile from the Reservoir.

Complete ventilation has been secured along the whole line of the Conduit by these Waste Weirs and one Ventilator built expressly for the purpose.

## VENTILATOR AND MAN-HOLES.

The only VENTILATOR, strictly so called, on the Aqueduct, is placed near the easterly end of the Tunnel, in Newton. It is built of hammered granite, and is eight feet square at the base, diminishing as it rises therefrom to a height of fourteen feet six and three-quarter inches, and is surmounted by a coping. The passage inside is four feet, one and a quarter inches. A great benefit derived from it consists in the means which it affords of an entrance into the Aqueduct, for the purpose of cleansing and examining. MAN-HOLES are also placed along the Aqueduct at distances of about a quarter of a mile apart, for the latter purpose. They are covered with stone slabs. A PLUG-HOLE, twelve inches in diameter, is also made near the Ventilator, to let off the water from the Aqueduct when necessary.

## CULVERTS AND DRAINS.

There are TEN CULVERTS and THIRTEEN BARREL DRAINS, for the purpose of draining off beneath the Aqueduct the water in its vicinity.

The CULVERTS are all of granite, with hammer-dressed joints, and laid in hydraulic cement. Their openings are from two to eight feet wide; the smallest being square in form, and the largest having upper and inverted arches.

The BARREL DRAINS have stone ends and brick centres, and are laid in hydraulic cement. They are from one and a half to two feet in diameter.

## TABLETS.

The TABLETS in the Gate houses, and other structures belonging to the works, bear the following INSCRIPTIONS:

On the Gate house at the lake, there are two Tablets, as follows:

### No. 1.

BOSTON WATER WORKS.

First Division; Length, 30,083 feet.

Commenced, Aug. 1846. Completed, Oct. 1848. Water was first let into the Conduit, Oct. 12, 1848.

| *Resident Engineer.* | *Contractors.* |
|---|---|
| T. E. Sickles. | Carmichael, Gonder & Co. |
| *Assistant Engineers.* | McCullough & Clark, |
| M. Conant, | Francis Blair, |
| Wm. E. Furguson, | George T. Wheeler, |
| G. H. Hyde. | Ebenezer Johnson. |

E. F. Knowlton, *Superintendent of Masonry.*

### No. 2.

BOSTON WATER WORKS.

John H. Wilkins, *President.*

| | |
|---|---|
| Ebenezer Johnson, | Samuel Hall, |
| Tisdale Drake, | John T. Dingley, |
| Ebenezer Atkins, | George P. French, |
| Samuel Hatch, | Samuel N. Dyer, *Clerk.* |

E. F. Knowlton, *Superintendent of Western Division,*
Albert Stanwood, " *Eastern* "
James Slade, *City Engineer,*
William F. Davis, *Water Registrar.*

Gate house raised 4 feet 8 inches.
Dam raised 2 feet.
Aug. 1, 1859.

On the bridge over the roadway, in the valley at Needham, near the west bank of Charles River:

BOSTON WATER WORKS.

Second Division; Length, 26,453 feet.

Begun Nov. 1846. Finished Oct. 1848.

| *Resident Engineer.* | *Contractors.* |
|---|---|
| H. S. McKean. | Clark, Christy & Co., |
| *Assistant Engineers.* | J. & C. Collins, |
| J. J. Spooner, | J. Healy, |
| S. S. Greele. | E. Lobdell. |

E. F. Knowlton, Superintendent of Masonry.

In the Gate house, at the Brookline Reservoir:

BOSTON WATER WORKS.

Third Division, 23,000 feet in length, including Reservoir. Brookline Tunnel, 1,130 feet, and Newton Tunnel, 2,410 feet.

| *Resident Engineer.* | *Contractors.* |
|---|---|
| T. S. Williams. | Ed. Leonard & Sons, for the Tunnels, |
| *Assistant Engineers.* | A. J. Hackley, for the Reservoir, |
| F. J. Williams, | Eb. Johnson, for this House, |
| J. A. Williams, | Bryant & Blaisdell, for Waste Weirs, |
| J. C. C. Hoskins, | Wm. Gawne, for Conduit, |
| *Architect for this House.* | C. G. Morrison, for Conduit. |
| C. E. Parker. | |

E. F. Knowlton, *Superintendent of Masonry.*

On the Beacon Hill Reservoir, there are three Tablets; two on the Derne Street Façade, and one on the lantern at the top of the staircase. The tablet on Derne Street, near the corner of Temple Street, is inscribed as follows:

BOSTON WATER WORKS.

Begun Aug. 1846. Water introduced Oct. 1848.

Josiah Quincy, Jr., Mayor.

Nathan Hale,
James F. Baldwin,
Thomas B. Curtis, } *Commissioners.*

That near the corner of Hancock Street:

BOSTON WATER WORKS.

W. S. Whitwell, Eastern Division,
E. S. Chesbrough, Western Division, } *Engineers.*
J. B. Jervis, Consulting,

This Reservoir completed Nov. 1849.

John P. Bigelow, *Mayor.*

On the panel of the Lantern:

BEACON HILL RESERVOIR.

Capacity, 2,880,000 gallons. Area of base, 36,920 feet.
Distance from Brookline Reservoir, 4 miles, 3,778 "
" South Boston, 2 " 2,110 "
" East Boston, 2 " 3,440 "
Corner Stone laid Nov. 20, 1847.

WATER COMMITTEE.

Josiah Quincy, Jr., *Mayor.*
William Parker,
George E. Head, } *Aldermen.*

James Whiting,
Samuel W. Hall,
Henry W. Dutton,
Jabez Coney,
William W. Greenough, } *Common Council.*

Benjamin Seaver, *President Common Council.*
James C. Dunn, *City Treasurer.*
Elisha Copeland, *City Auditor.*
Peleg W. Chandler, *City Solicitor.*
Francis Tukey, *City Marshal.*
Samuel F. McCleary, *City Clerk.*

George H. Bailey,
James Slade,
James F. Shephard,
Frederick Budden, } *Assistant Engineers.*

Charles Pratt, *Superintendent.*
Samuel Holbrook, *Commissioners' Clerk.*

Charles G. Case, Samuel Farwell, } *Builders.*

Eames, Stimpson & Co., Jeremiah Wetherbee & Co., } *Contractors for Stone.*

Completed Nov. 15, 1849.

WATER COMMITTEE.

John P. Bigelow, *Mayor.*

William Pope, Samuel Hall, } *Aldermen.*

William W. Greenough, Joseph Smith, John P. Putnam, Robert Marsh, Richard B. Callender, } *Common Council.*

# CHAPTER XXIII.

Newton Aqueduct and Company — The property of the Company — Agreement between the City and the Company — Brookline Reservoir — Small Conduit in the embankment — Gate Houses — Beacon Hill Reservoir — South Boston Reservoir — East Boston Reservoir — Compensating Reservoirs — Jamaica Pond Aqueduct — Chestnut Hill Reservoir.

## Newton Aqueduct.

Among the claims which were made on the City for damages arising out of the construction of the Aqueduct, were several for large amounts for injury occasioned by draining off the springs in the neighborhood of the Newton Tunnel.

To meet these demands, and obtain the means of compensation for them, an Aqueduct was constructed in Newton by means of the formation of a company, under the provisions of the law of the Commonwealth, called the Newton Aqueduct Company. The particulars of this organization will be found in Part II., Chapter XIV.

The property of the company consists of a large well, which was dug on the land now or formerly of John Ward, in Newton, and a Reservoir formed beneath the surface, at a sufficient elevation, from which a 4-inch iron pipe was laid through the streets; and from this main branches are taken by one-half inch inside diameter lead pipe, leading into five cisterns on different farms. These cisterns are of brick, laid in cement and made water tight, and of sufficient size to hold three hundred gallons each; at the end of each supply pipe is attached a ball and stopcock, to prevent the overflow of the cistern and the waste of water.

The several holders of water-rights are restricted to use the water by means of suction pumps only, and have agreed to keep their own cisterns, leading pipes and pumps in good order and in suitable repair, and not to make or suffer any waste of the water, nor permit any to be taken away from their premises.

December 20th, 1849, the City of Boston entered into an agreement with the Aqueduct Company to assume the care of the works, and carry out all the terms of an agreement entered into by the said Company with Ann Brackett, Clarissa Brackett, Hannah Brackett, Francis Pettee, and Ann Pettee his wife, all of Newton, and Silas Stevens, and Sarah Stevens his wife, of Brighton. In this agreement, these parties relinquished all claims on the City of Boston which they had at any time heretofore or then had for damages of every kind and nature, on account of the construction of the Cochituate Water Works; the agreement of the Company was, to furnish the said parties and their successors with water from their Aqueduct in said Newton, so long as there is a supply in the well from which said Aqueduct leads; and that they would keep said Aqueduct in good order, so that the water would run through the same when there was a sufficient quantity in the well.

It was expressly understood and agreed, that the company did not warrant, or intend to warrant, the continuance of a supply of water in said well, nor were they to be responsible or liable if it should fail at any time hereafter, from any cause whatever, except from the stoppage of the main pipe.

The company also reserved the right to supply other parties, and to limit the supply to the above first mentioned parties, in the event of a drought or scarcity, to one hundred and fifty wine gallons in twenty-four hours.

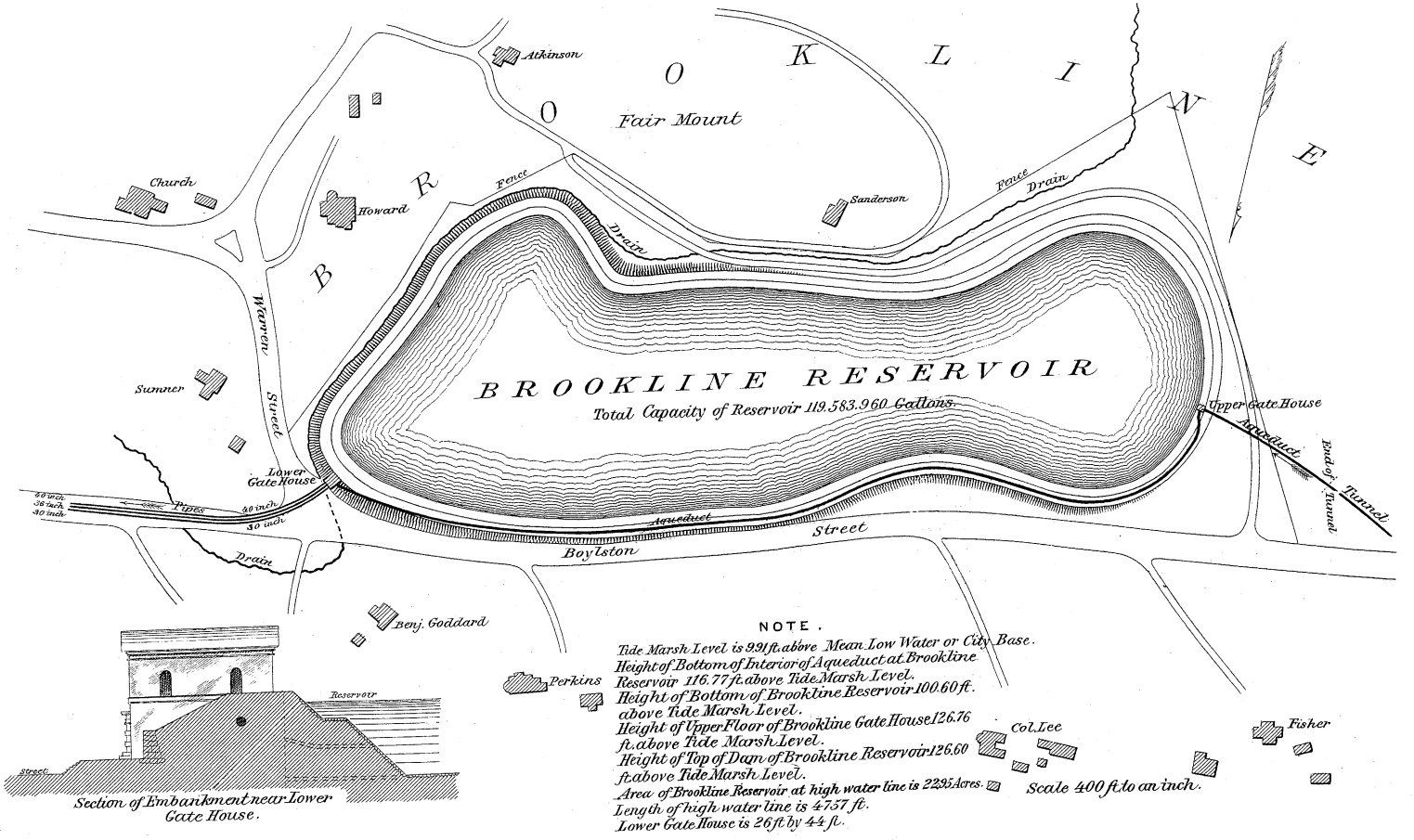
### Brookline Receiving Reservoir.

The Brookline Reservoir is situated at the Eastern termination of the brick portion of the Aqueduct, in Brookline.

It is formed out of a natural basin, enclosed almost entirely by banks rising to a considerable height above it. On the northerly side, however, there was no bank; consequently a puddled embankment was built up to a height of about twenty-six feet, and was supported by a retaining wall eight feet in height. For the purpose of protecting the banks from the action of the water the inner slope of the Reservoir is lined with a slope-wall of granite rubble, eighteen inches thick, and fourteen feet broad; this lining rising to within one foot of the top of the bank.

The greatest depth of water is near the principal gate-house, twenty-four feet. The least depth is near the upper gate-house, where it is about fourteen feet. The embankment is twenty feet wide at the top, with a gravel walk all around.

The area of the Reservoir, at a level of six feet below the top of the dam, is 22.31 acres, and its capacity 89,909,730 wine gallons; the contour of the water line being 4,696 feet long. At two feet below the top of the dam, it




NOTE.

Tide Marsh Level is 9.91 ft. above Mean Low Water or City Base.
Height of Bottom of Interior of Aqueduct at Brookline Reservoir 116.77 ft. above Tide Marsh Level.
Height of Bottom of Brookline Reservoir 100.60 ft. above Tide Marsh Level.
Height of Upper Floor of Brookline Gate House 126.76 ft. above Tide Marsh Level.
Height of Top of Dam of Brookline Reservoir 126.60 ft. above Tide Marsh Level.
Area of Brookline Reservoir at high water line is 229.5 Acres.
Length of high water line is 4757 ft.
Lower Gate House is 26 ft by 44 ft.

Scale 400 ft. to an inch.

contains an area of 22.95 acres, and the capacity is 119,583,960 gallons; the contour of the water line is, at this level, 4,757 feet. The Reservoir in shape is an irregular oval.

A cylindrical brick CONDUIT is laid at a depth of eight feet within the northern embankment, to connect with that from the Lake, and conduct the water around the Reservoir to the Pipe Chambers, by means of which it was intended that the supply of the mains should be kept up, when the water is shut off from the Reservoir for cleansing it, or for any other purpose. This answered the purpose for the first few years; but afterward the consumption increased so much, that it became wholly inadequate.

There are two FIRE-PROOF GATE HOUSES, the upper for receiving the termination of the brick portion of the Aqueduct, and the lower for the commencement of the iron Main leading to the City, with regulating gates, gauges, etc.

The PRINCIPAL or lower GATE HOUSE has its front on the street, where it is twenty-six feet, four inches wide, by thirty-six feet, eight inches high, including the basement, which is sixteen feet, four inches. It is set in the embankment and projects about four feet in front of the retaining wall. The height in the rear is twenty feet. The length of the building is forty-four feet, four inches. Two iron stair-cases ascend from the basement to the main floor.

The building is of hammered granite with an iron roof. The main floor is on a level with the top of the embankment, and the bottom of the gates which regulate the admission of water into the Pipe Chambers is twenty-six feet below the floor.

The gates and gate frames are of iron, plated with composition metal, set in hammered granite. They are worked by composition screws in composition nuts. There are three pipe chambers, into which the mains now laid are introduced; two only having been used until the year 1859, when the 40-inch main was laid over the Mill-dam.

At the UPPER GATE HOUSE is the termination of the brick Aqueduct, and it is fitted with Stop Planks and a Flap Gate for regulating the flow of water into the Reservoir. The building is of granite, with a stone roof. The front is eleven feet, three inches wide, by eleven feet, four inches high, and the length twelve feet.

| | | | | |
|---|---|---|---|---|
| The top of the dam or embankment is | 126.60 | above | tide marsh | level. |
| The upper floor of the principal gate house, | 126.76 | " | " | " |
| Low water mark, | 120.60 | " | " | " |
| The bottom of the interior of the Aqueduct, | 116.76 | " | " | " |
| The bottom of the Reservoir, | 100.60 | " | " | " |

An account of the land purchased for this Reservoir will be found in Part II., Chapter XII.

### Distributing Reservoirs.

There are three Distributing Reservoirs constructed for the purpose of receiving the water from the Mains leading from the Brookline Reservoir during the latter part of the day and the night, when it is presumed but little will be drawn from the Service-pipes; and of supplying it to the Service-pipes in the morning, when the greater portion for domestic purposes is required. By this means, a continuous supply can be kept up to a more uniform height.

### Beacon Hill Distributing Reservoir.

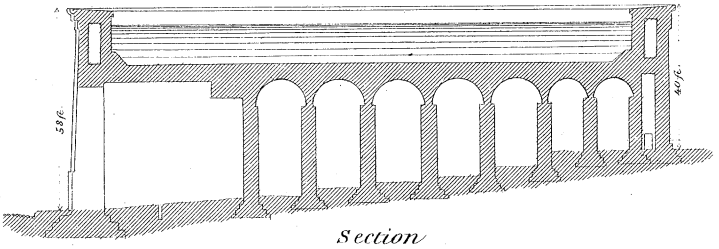
The most costly Distributing Reservoir belonging to the Water Works is erected nearly on the site where the monument on Beacon Hill formerly stood. The foundation of the Reservoir is more than seventy feet below the original height of the hill.

It is bounded northerly by Derne Street, one hundred and ninety-nine feet, three inches; easterly by Temple Street, one hundred and eighty-two feet, eleven inches; southerly by the yards to the dwelling-houses fronting on Mount Vernon Street, two hundred and six feet, five inches; and westerly by Hancock Street, one hundred and ninety-one feet, seven inches; and it is built with great care and labor of the most massive description of stone masonry.

The whole structure is of granite, laid in hydraulic cement, with hammered beds and builds, and an undressed external surface, surmounted with a deep, dressed cornice. The outer walls are three feet thick; and the one on Derne Street is pierced with five arches, and rises above the sidewalk fifty-eight feet, nine inches, to the top of the coping. The rise in the grade on both Temple and Hancock streets, from Derne Street to the southerly corners of the Reservoir, being eighteen feet, leaves the coping at those corners forty feet, nine inches, above the sidewalks.

The bottom of the basin containing the water is fifteen feet, eight inches, below the top of the coping. The lateral walls of the basin are built twelve feet within the exterior walls of the Reservoir. They are of granite, five feet thick at the lower part, and three feet at the top. The bottom of the Reservoir is covered with concrete to a depth of three feet, and afterwards paved with two courses of bricks.

The basin is supported on arches of granite. Of these arches, seven extend parallel from Hancock Street towards Temple Street, from wall to wall. They are from eleven feet, nine inches, to fifteen feet, six inches, between

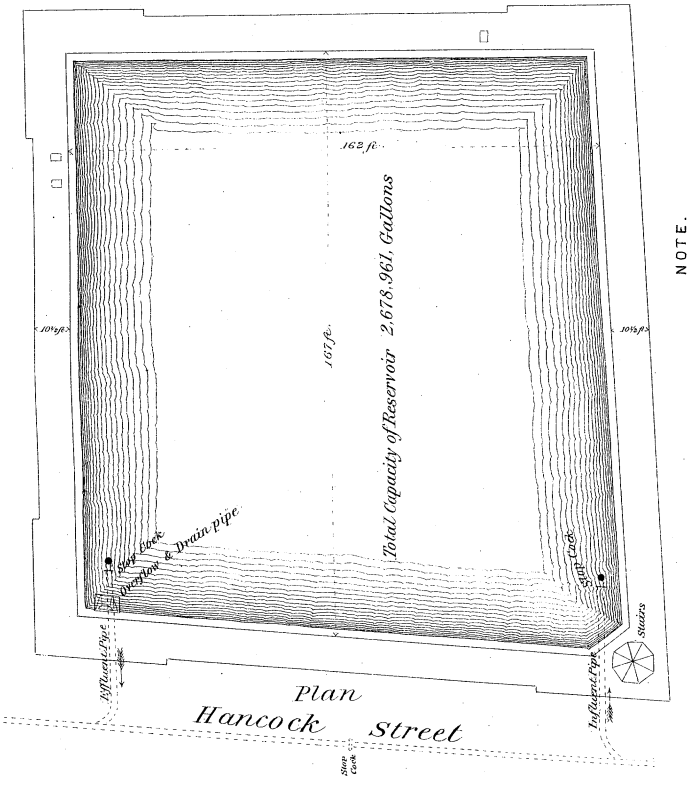



Section

# Beacon Hill Reservoir
# Boston

Temple Street

Derne Street




Plan

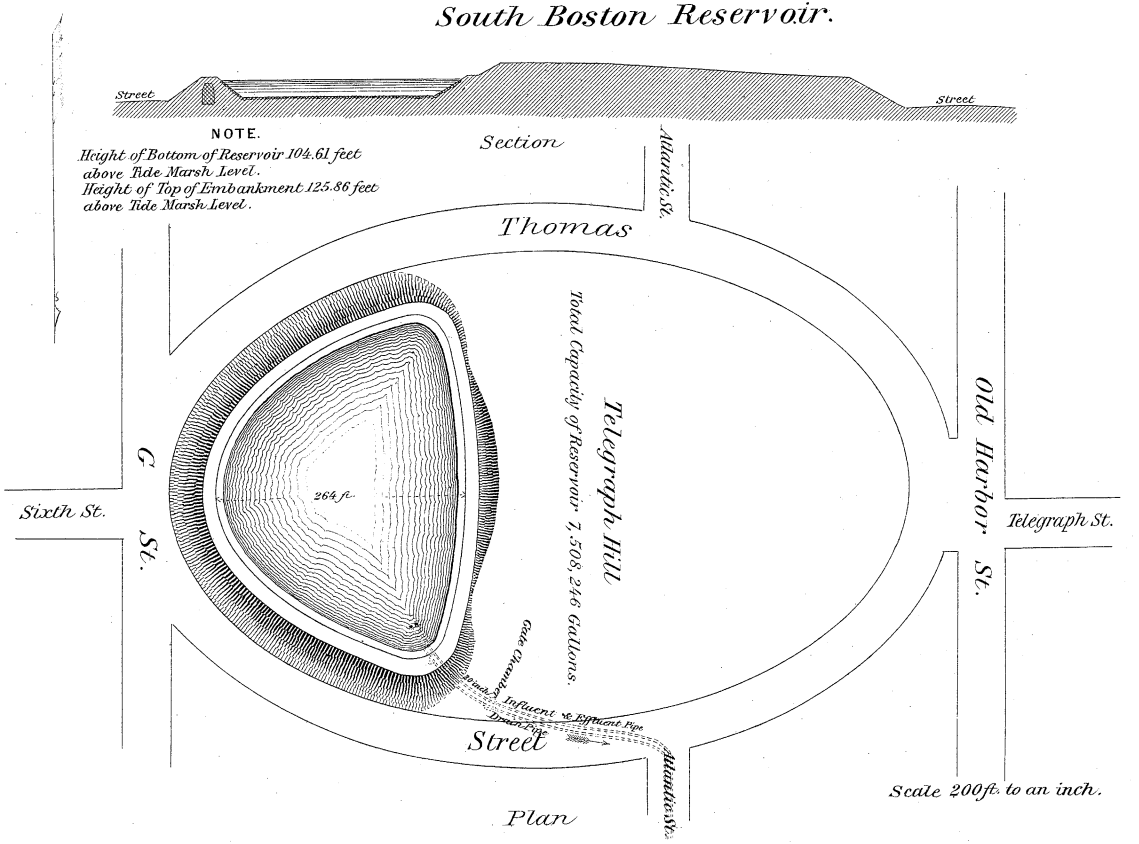
Hancock Street

Stop Cock

NOTE.
Height of Bottom of Reservoir 108.47 feet above Tide Marsh Level
" " Top of Coping (outside) 124.47 " " " " "

Scale 60 ft to an inch.

# South Boston Reservoir.



the piers, and, varying with the declivity of the foundation, are from twenty-three to thirty-two feet high. They give support to about two-thirds of the superstructure, extending from the rear of Mt. Vernon Street until they meet the arches running from Derne Street at right angles to them.

The Derne Street arches, seven in number, extend back from Derne Street fifty-seven feet and six inches; they are twenty feet, three inches wide, and vary in height with the declivity of the land from thirty-seven to thirty-nine feet, the piers supporting the arches being three feet through. Five of them open on the street, varying in height from thirty-six feet to thirty-eight feet, and being fourteen feet, nine inches wide.

The lateral walls of the basin rest on the course of concrete; and there is a space of four feet, nine inches between them and the outer walls. It is estimated that 17,000 cubic yards of hydraulic masonry and concrete were used in the construction.

The Influent Main is introduced in the southwestern corner of the structure; and a staircase, in the same corner, contains a flight of stone steps leading to the top, and is protected on the top by a lantern, of cast-iron, nine feet one inch high, by ten feet six inches wide, in the interior.

The Effluent Main, thirty inches in diameter, passes out at the northwestern corner.

The contents of the basin are equal to 2,678,961 gallons, its mean horizontal section being 28,014 square feet. The maximum, or high water level, in Brookline Reservoir, which now is 124.60 feet above tide marsh level, is eleven inches above the coping of the Beacon Hill Reservoir, or sixteen feet, seven inches above the bottom of the basin; the minimum level of the Brookline is four feet below this line. The bottom of the Reservoir is

| | |
|---|---|
| Above tide marsh level . . . . . | 108.47 feet. |
| The top of the coping outside . . . . . | 124.47 " |
| The bottom of the Waste Weir . . . . . | 121.53 " |

### South Boston Distributing Reservoir.

The South Boston Reservoir is placed on the east side of Telegraph Hill, South Boston. The walls are formed of a puddled embankment, lined inside with granite rubble, and the bottom paved with pebble stones. It resembles in shape a segment of an ellipse, measuring across the widest part about three hundred and seventy feet, and about two hundred and sixty-four across the narrowest part. Its capacity is 7,508,246 gallons. The top of the dam is 125.86 feet above tide marsh level, and the bottom of the Reservoir is 104.41 feet. High water mark in the Reservoir is seventeen feet, nine

iuches, above the bottom, and one foot, nine inches, below low water mark at the Lake.

### East Boston Distributing Reservoir.

The East Boston Reservoir is placed on Eagle Hill, East Boston.

Its walls are formed by a puddled embankment, lined with stone in the interior; the bottom paved, and covered with concrete. It is rectangular in shape, measuring three hundred and twenty-two feet by one hundred and fifty; and contains, at a level three feet below its top, 5,591,816 wine gallons. High water mark is twenty-seven feet above the bottom of the Reservoir, and seventeen feet, three inches below low water mark at the Lake. The outside slope of the embankment, on the west, is ninety-three and one-half feet; on the east, seventy and one-half feet; on the south, sixty-seven feet, and on the north, fifty-six feet. The top walk is seven feet wide.

### The Compensating Reservoirs.

The City purchased and held two Compensating Reservoirs in the towns of Hopkinton and Marlborough, as mentioned in Part II.

The Hopkinton, or Whitehall Reservoir, was situated in the town of Hopkinton, in the county of Middlesex. Following the very circuitous course of Sudbury river, into which it discharges, it was about eighteen miles distant from the outlet of the Lake.

The Reservoir extended over an area of five hundred and seventy-six acres, the height of the dam was ten feet, ten and one-half inches, and when full the water was nine feet, ten and two-thirds inches deep.

Its capacity was estimated at 125,403,290 cubic feet, or 940,524,675 wine gallons.

The Marlborough, or Fort Meadow Reservoir, was situated in the town of Marlborough, in the county of Middlesex, about twelve miles distant from the Lake.

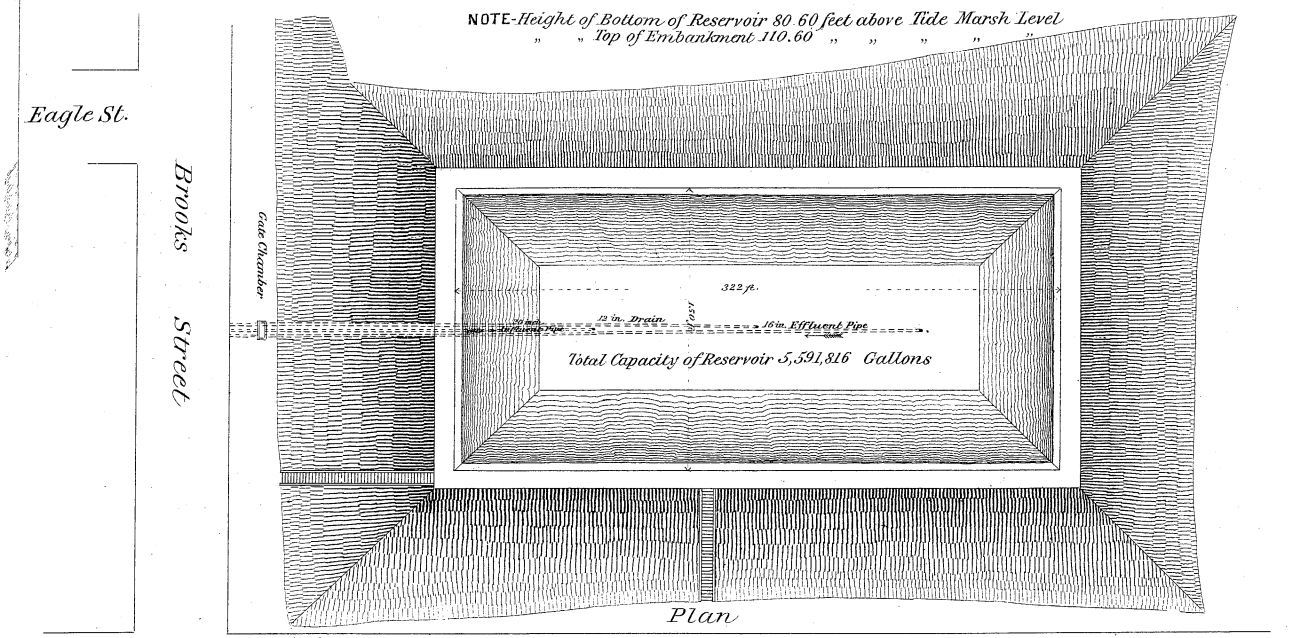
This Reservoir had a water-shed of 2,257 acres, and covered an area of two hundred and ninety-nine acres. The height of the dam was thirty feet, and when full, the water was twenty-five feet deep; it discharged into the Assabet river, and following its course was about fourteen miles distant from its union with Sudbury river, by which the Concord river is formed. The capacity of the Reservoir was estimated at 185,932,787 cubic feet, or 1,394,495,902 gallons.

Ramshorn and Boon Ponds, lying about two miles distant, were included in the purchase of this Reservoir.

# East Boston Reservoir.

Section

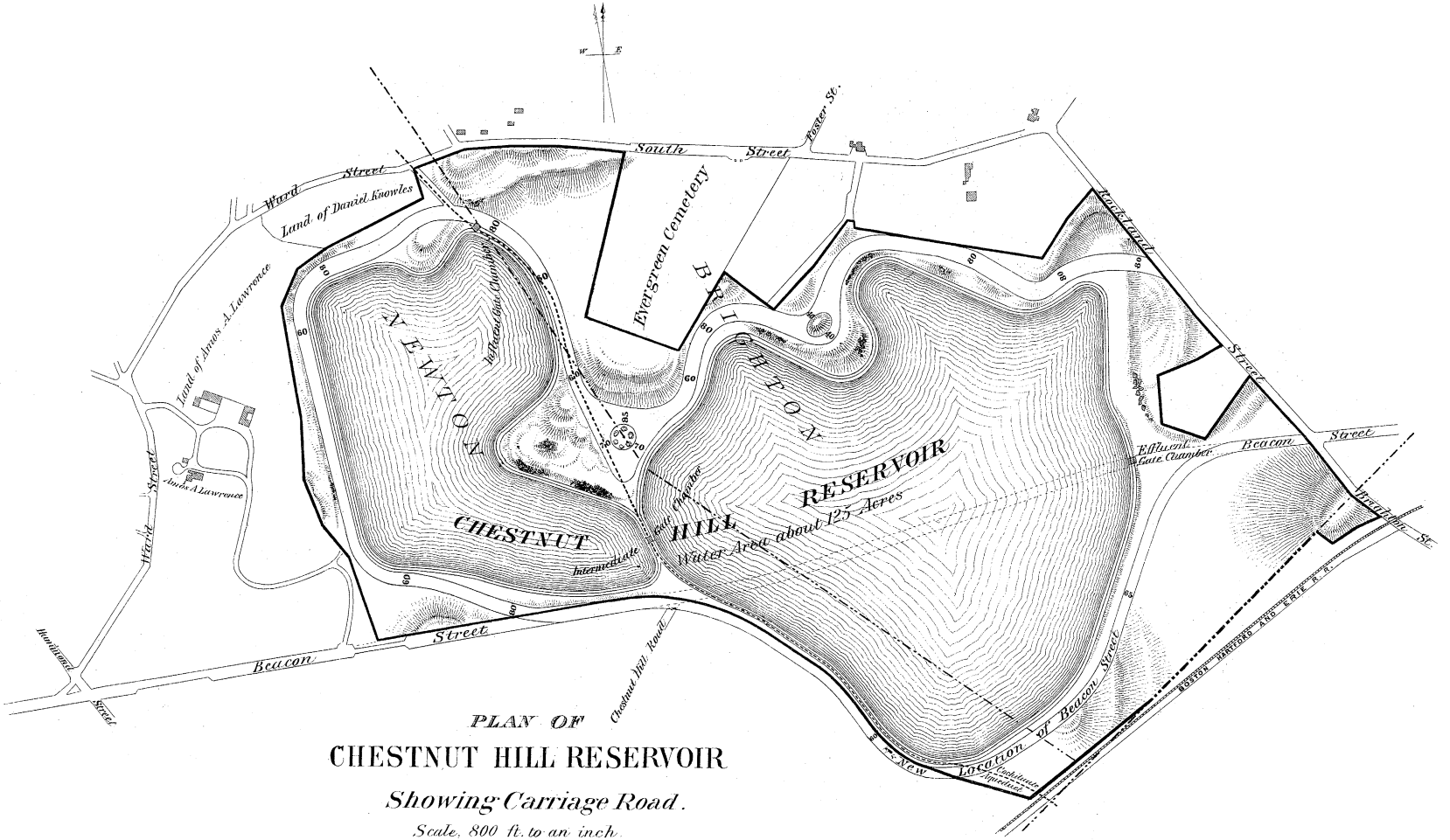
NOTE-Height of Bottom of Reservoir 80.60 feet above Tide Marsh Level
" " Top of Embankment 110.60 " " " "




Plan

Scale 100 feet to an inch.

White Street



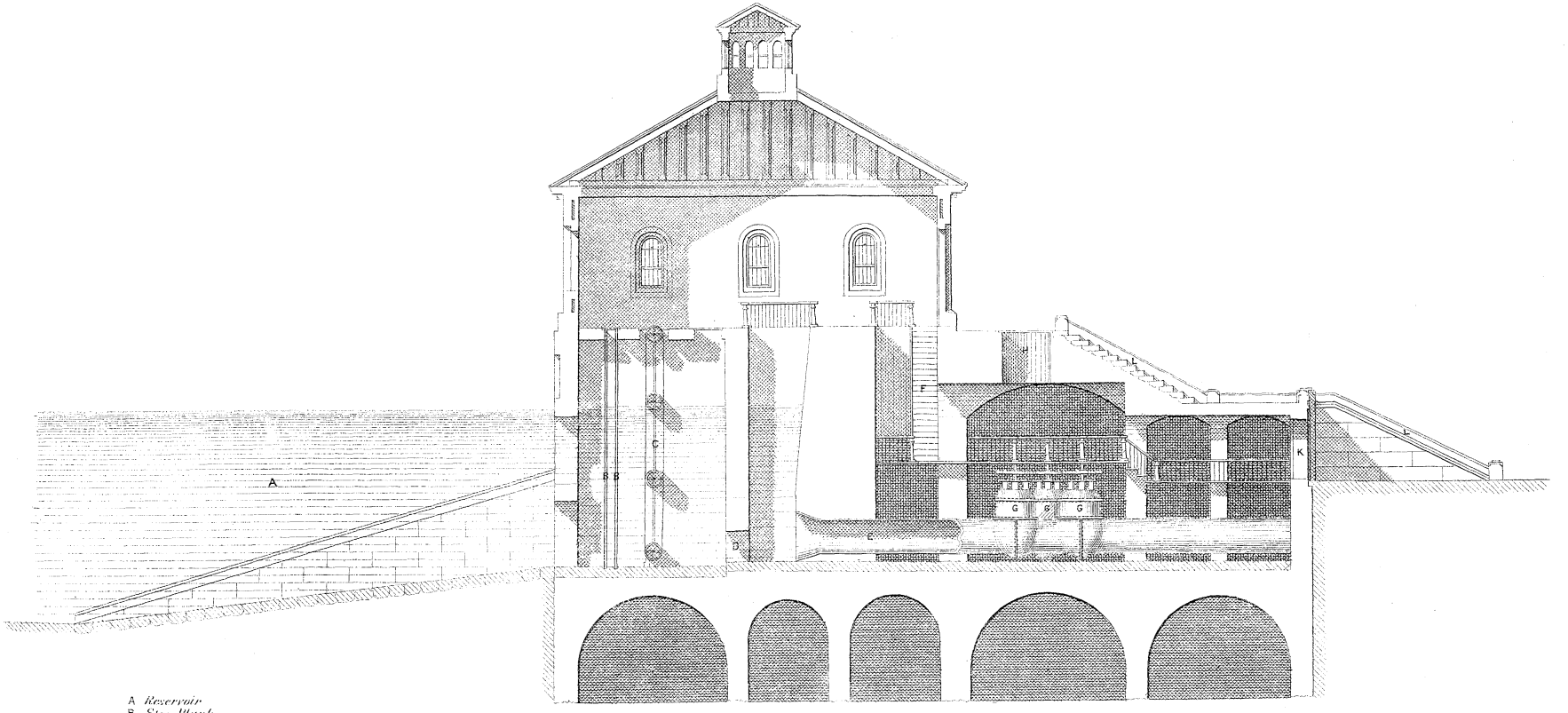

PLAN OF

# CHESTNUT HILL RESERVOIR

*Showing Carriage Road.*

*Scale, 800 ft. to an inch.*

*1868.*




A *Reservoir*
B *Stop Plank*
C *Rolling Screen*
D *Gates*
E *48 inch Pipes*
F *Stairs down from Upper Floor*
G *Stop Cocks*
H *Light to Pipe Chamber*
K *Door under Embankment*
L *Steps up to Gate House.*

*Longitudinal Vertical Section*
*of*
*Lower Gate House*
*at*
*Chestnut Hill Reservoir.*

The Hopkinton Reservoir cost the City, when completed, ready for use, $29,534.36, and the Marlborough, $43,170.59.

The Marlborough Reservoir was sold in 1858, and the Hopkinton, in 1859, the particulars of which sale have already been given in Part III., Chapter XIX.

### Jamaica Pond.

In the year 1851, the Water Board purchased, in behalf of the City, the franchise and property of the "Aqueduct Corporation," owners of Jamaica Pond, in Roxbury, for the sum of $45,237.50. This was sold in the year 1856, for the sum of $32,000, the particulars of which sale are given in Part III., Chapter XVIII.

The Pond is situate in the town of Roxbury, in the county of Norfolk. The surface of the water at its minimum level, or when one foot above the lower side of the effluent pipe, is, according to a survey of the pond made by Col. Loammi Baldwin, 1833, 45.27 feet above the coping of the dry dock at the Navy Yard in Charlestown, or 50.36 feet above tide level. At the time of the survey, the water was 4.43 feet above the minimum level, and covered an area of 67.22 acres, or 2,928,103 square feet.

An iron main, ten inches in diameter, was laid in 1840. It passed from the pond to the street, by Mr. Ward's farm-house, and thence, partly beneath the street and partly through the land of Ebenezer Francis and others, to Tremont Street, and by that street to Bowdoin Square in Boston. This pipe was disconnected at the line between Boston and Roxbury at the time of the sale of this property by the City, but the portion in Boston has never been taken up.

### Chestnut Hill Reservoir.

This Reservoir is still in the course of construction. When it is completed, the Water Board will of course give a detailed and elaborate report of it; and therefore only the following general description is now given:

The land selected is a natural basin, containing over two hundred acres, situated about five miles from City Hall, and a mile from the Brookline Reservoir, near Chestnut Hill from which the Reservoir derives its name, and lying in the towns of Brighton and Newton: the former course of Beacon Street being interrupted and carried around it.

The Reservoir will be about two and a half miles in circumference, and is divided into two basins of irregular shape; the upper, or Lawrence Meadow Basin, having a water surface of about thirty-seven and a half acres, and the lower basin, a water surface of eighty-seven and a half acres. The average

depth of the upper basin will be about fifteen, and that of the lower basin, twenty feet. The entire capacity of both is nearly eight hundred million gallons, a quantity sufficient to supply the City, at its present rate of consumption, for nearly two months, and equal to five times the capacity of the other four Reservoirs.

The declivities of hills around the Reservoir form a natural foundation for a large part of the marginal bank; for the remaining portion, however, it has been necessary to construct an embankment of about two thousand feet in length, and varying in height, the greatest altitude being about thirty-five feet.

To protect them from the wash of the water, the inner slope of the banks is lined with stone two and a half feet thick, extending downward nineteen feet on an inclined plane of two feet in one; and at the foot of this stone lining, another embankment or berme is formed for the support of the first lining; it is five feet wide on top, and has a slope of three feet in one.

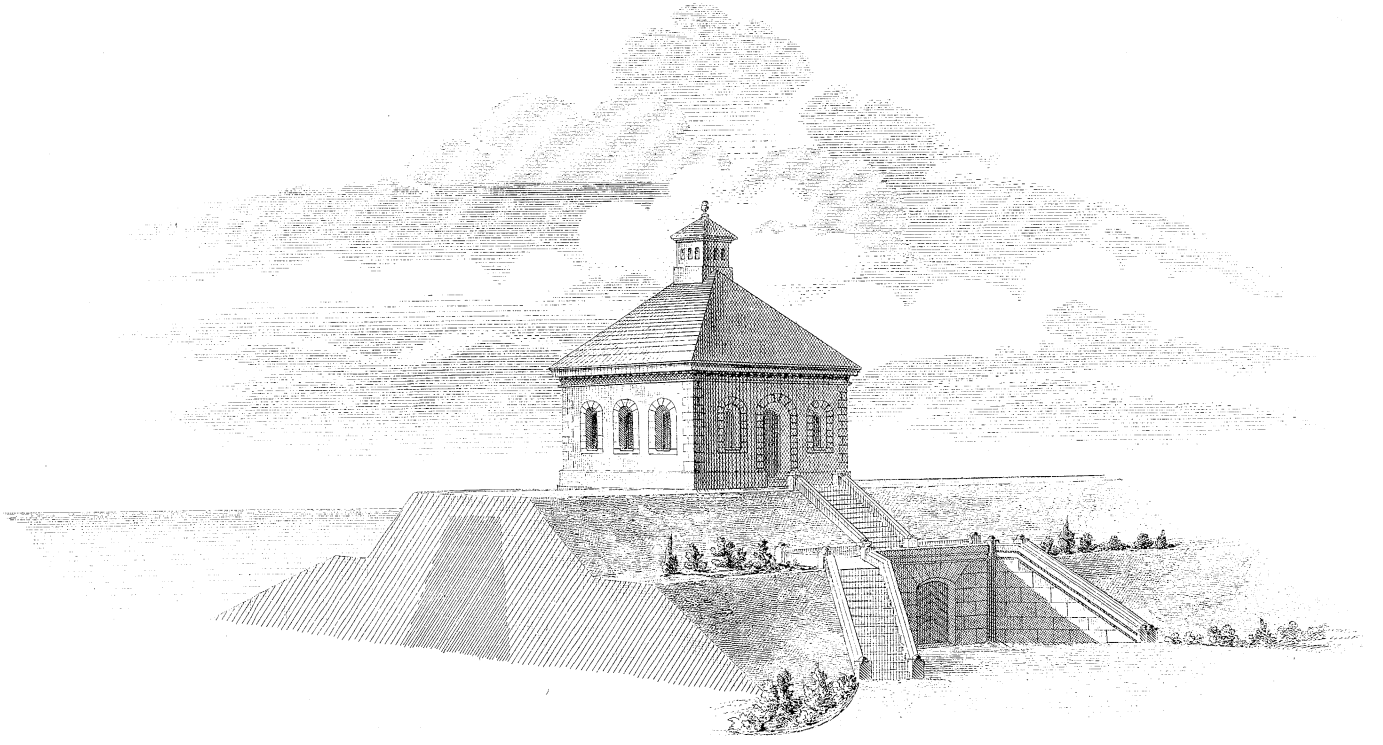
The two basins are separated by a water-tight dam, at the centre of which is the Intermediate Gate House, so arranged as to connect the two when necessary; and as the main Conduit runs lengthwise through this dam, the water can be let into one or both basins at this point; or the water from the Lake can be shut off, and the Brookline Reservoir supplied from this Reservoir through the brick Conduit.

There is also to be an Influent Gate-House on the northeast corner of the upper basin, and an Effluent Gate-House on the easterly side of the lower basin, near the corner of Beacon and Brighton streets. From the latter house, a 48-inch iron Main will be laid, to connect with the present mains near the gate house in Brookline. This building will be sufficiently large, and expressly arranged for three other Mains of the same size whenever they may be required.

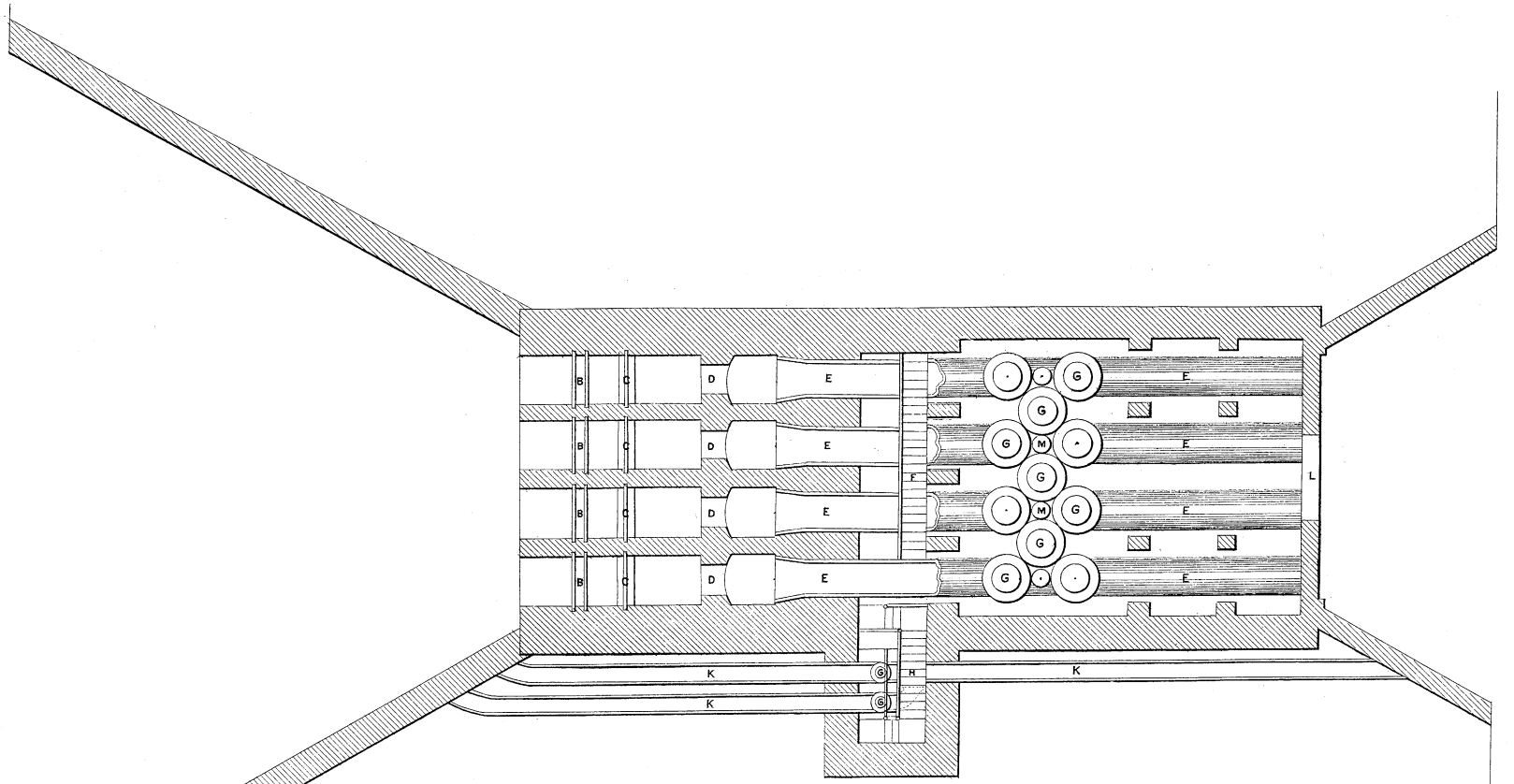
Around the entire margin, there will be a gravelled Walk, eight feet wide, with six feet of sodding on each side of it; and outside of this walk there will be a Driveway, varying in width from sixty to eighty feet.

A large portion of this Driveway will be on a level with the embankment; some portions, however, rise to thirty feet above it, giving an uninterrupted view of both basins. At some points, it will be carried away a short distance from the margin, through groves; at others, it will be widened, passing on either side of large bowlders; and its curvatures, and the diversified character of the scenery through which it passes, will add to its attraction.

To give a general idea of what is contemplated, we annex Plans of the Grounds and of the Gate Houses.



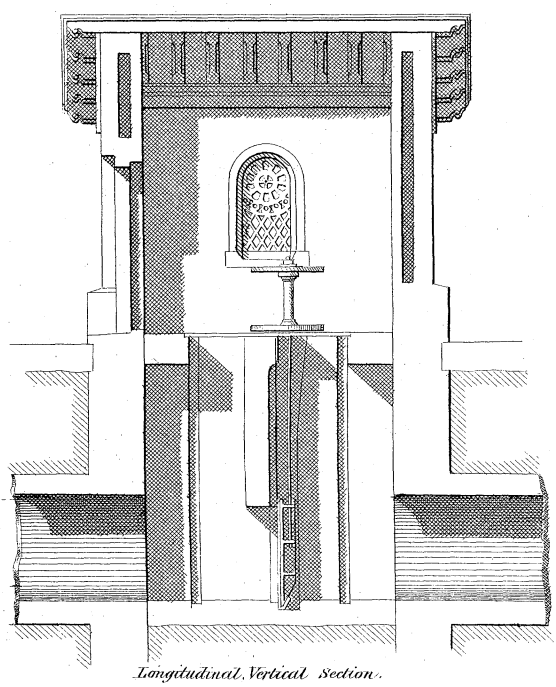
*Lower Gate House*
*at*
*Chestnut Hill Reservoir.*



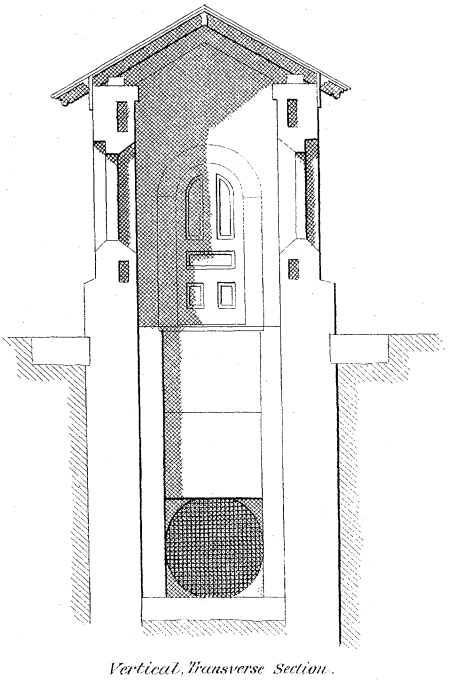

*Horizontal Section above Lower Floor*
*of*
## *Lower Gate House*
*at*
## *Chestnut Hill Reservoir.*

A *Reservoir*
B *Stop Plank*
C *Rolling Screen*
D *Gates*
E *48 inch Pipes*

F *Stairs down from upper Floor*
G *Stop Cocks*
H *Stairs down to Drain Pipe Chamber*
K *20 inch Drain Pipes*
L *Door Under Embankment*
M *Man Holes*

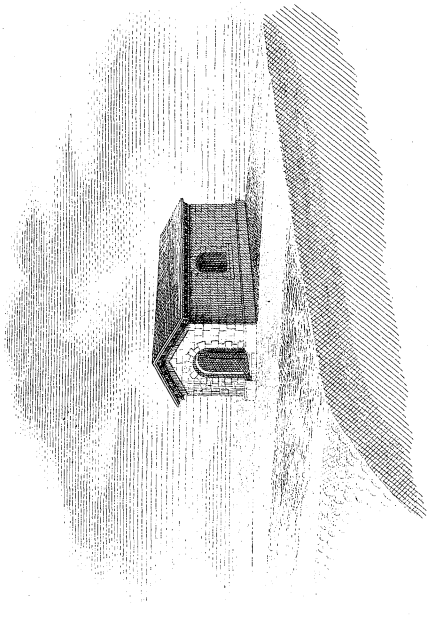


Longitudinal, Vertical Section.

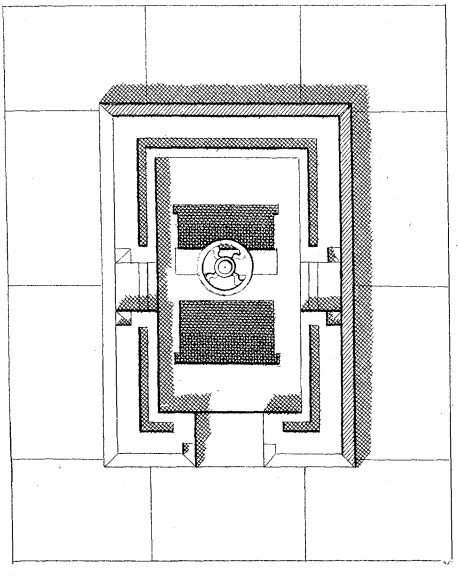


Vertical, Transverse Section.

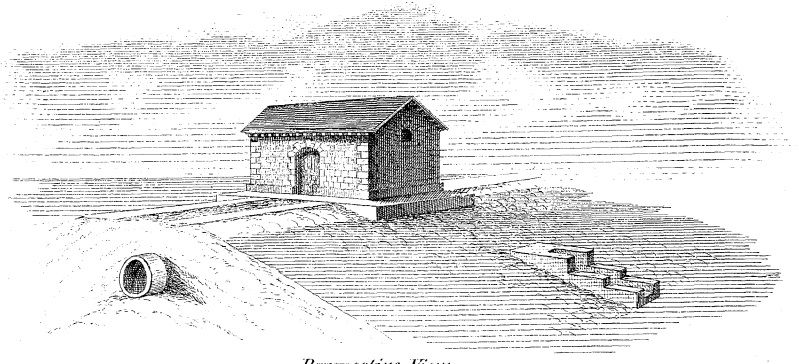
# Influent Gate House
## at
# Chestnut Hill Reservoir.



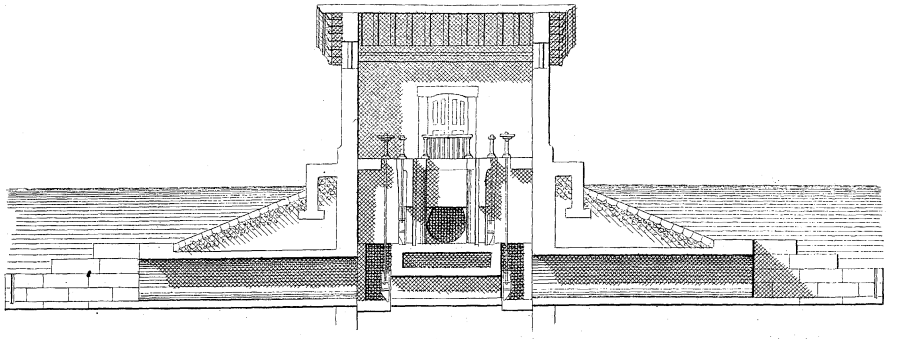
Perspective View.



Plan.

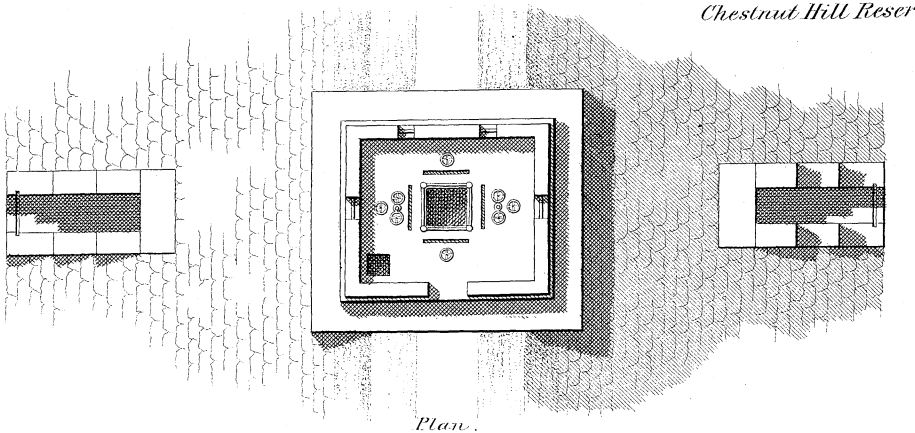


*Perspective View.*

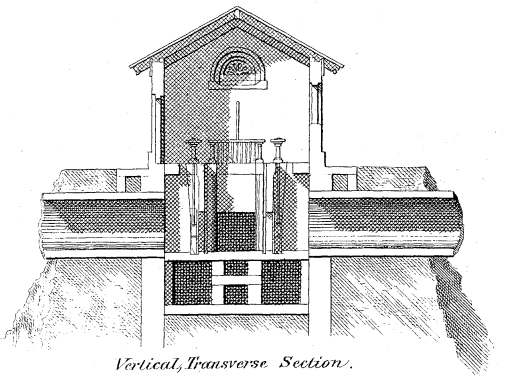


*Longitudinal, Vertical Section.*

# *Intermediate Gate House at Chestnut Hill Reservoir.*



*Plan.*



*Vertical, Transverse Section.*

# CHAPTER XXIV.

The Mains — Route of the Thirty-six and Thirty-inch Mains — Route of the Forty-inch Main — Distributing Pipes and their size — South Boston Main — East Boston Main — Gates, Air Cocks, Blow-offs and Hydrants connected with the Mains — Service-Pipes — Public Fountains — Cost of the Works.

## The Mains.

From the Reservoir to the City, the Conduit consists of three Iron Mains; one forty inches, one thirty-six inches, and the other thirty inches in diameter. The 36 and 30-inch pipes are laid side by side, the 36-inch pipe on the southerly side of the 30-inch pipe, beneath the public highway which was formerly the Worcester Turnpike, to Brookline village, with the exception of about one hundred feet in length in Mr. Goddard's land near the gate house; and thence by the public streets, through Brookline and Roxbury, to Tremont Street in Boston, and through that street to Dover Street, a distance of about three miles and two-thirds from the Reservoir.

At this place, the 36-inch pipe is reduced to one of thirty inches, and these two Mains pass together through Tremont Street to Boylston Street. From this point the Main, originally thirty inches, is laid across the Common, through Joy and Mt. Vernon streets to Hancock Street, to supply the Reservoir on Beacon Hill. It then passes by the side of the Reservoir, through Hancock and Cambridge streets, to the corner of Chardon Street in Bowdoin Square.

The originally 36-inch Main, which had been reduced to thirty inches, passes down Boylston Street to Washington Street. It is there again reduced to one of twenty-four inches, and passes through Washington Street, Dock Square, Union, Merrimac, Ivers and Chardon streets to Bowdoin Square, where it joins the other 30-inch Main.

The two Mains are laid at a sufficient depth to be secure from frost, and are carried across the Boston and Worcester, now Boston and Albany, Rail-

road in Tremont Street, outside and west of the street bridge there, on an independent fire-proof structure.

The 40-inch Main, which was laid in 1859, eleven years after the introduction of water into the City, commences at the Brookline Reservoir, and is connected by a taper pipe with a 30-inch pipe that was originally laid through the bulkhead of the Reservoir, as it was not considered safe to remove it; but on top of the taper pipe, there is a 20-inch inlet, which is now capped, and can be connected through the bulkhead above the present pipe, if the supply should prove insufficient.

From the Reservoir, this Main is laid on the southerly side of the 36-inch Main, until it reaches a point known as the Punch Bowl corner, a distance of about 5,190 feet; at this point, it passes under the other Mains, and runs in a northeasterly direction until it reaches the Mill-dam road, where it turns and runs in an easterly direction on the southerly side of the Mill-dam road to the corner of Charles and Beacon streets. In reaching this point, it passes over the culvert at Appleton Place and over the high and low water gates in the Mill-dam, resting on the abutments. Trusses are also placed on each side of the pipe, and the whole covered with plank, and the roadway made good by a covering of gravel.

At Charles Street, it enters the Common under the gate-way, and crosses the Common diagonally, passing under the 36-inch Main that supplies Beacon Hill Reservoir to a point opposite the corner of Mason and Tremont streets; at which place, it is connected with the continuation of the 36-inch Main, and then turns at a right angle, and continues by the side of the 30-inch Main for about five hundred and forty feet; then curves into Tremont Street, on the east side, to the corner of Boylston Street, where it connects with the reduced 36-inch Main.

A 12-inch Connection is made with this 40-inch main at Arlington Street to assist in the supply of the Back Bay lands; also a connection at Charles Street to supply Beacon Street as extended.

There are also two Branches connected with the Main, one opposite Appleton Place, and one on the west side of the low water gates; the latter has a 36-inch outlet.

On the Mains, there are seven air valves, placed at the different summits along the line, and sixteen Man-holes, which are cast in the pipes, and are placed about one thousand feet apart.

Three Hydrants are also located on the line, two in Brookline, one in Roxbury and six Blow-offs are in the first hollow from the Reservoir and at the

Punch Bowl corner, two at the Mill-dam corner, one on the west side of the low water gate, and one at the corner of Charles and Beacon streets.

The work of laying this 40-inch main was commenced April 8th, 1859, and was completed May 8th, 1860, at an expense of $304,991.83. The total number of pipes purchased for this main was 1,947, besides the branches and reducing pipes; and the total weight of metal, 5,827 tons, which cost $196,004.12.

### Distributing Pipes.

By the side of the Mains, and connected with them at intervals, is laid a Side pipe, six inches in diameter; except from Northampton to Dwight Street, on Tremont Street, where it is twelve inches diameter. The object of this is to prevent the necessity of interrupting the flow of water through the Mains, when it is required to supply a new tenant, which otherwise could only be done by drawing off the water from the main for several hundred feet, while the work was going on.

From the Mains as they pass by the several streets in their route, the Distributing pipes of four, six, twelve and sixteen inches in diameter, branch off.

Those of six inches in diameter, generally, and all under, are connected with the attending side pipe; and those of a greater diameter enter directly into the mains.

At Dover Street, a pipe of twenty inches is connected with the 36-inch Main, and passes through Dover Street under South Boston Bridge, to South Boston Reservoir. At the draw, the pipe is carried down into a trench excavated in the hard bottom of the channel, a distance of thirty-two and a half feet below the top of the bridge, and brought up on the opposite side, the syphon being laid in a box filled in with hydraulic cement. The distance between the arms of the syphon is forty-one feet. The pipe then passes through Fourth and Atlantic streets to Telegraph Hill, where it enters and supplies the Reservoir. Branch distributing pipes are connected with it as it passes along its route.

At the junction of Union and Merrimac streets, in the City proper, a pipe of twenty inches diameter is connected with the 24-inch Main, which is the continuation of the 36-inch main, and passes through Union and Beverly streets, on the lower side of Warren Bridge, to Charlestown, making at the

draw of this bridge a syphon with a dip of thirty-six feet, and distance between arms, of thirty-nine feet.

This pipe passes through Charlestown by Chelsea Street, and on the upper side of Chelsea bridge to CHELSEA. At the southerly draw of this bridge, the one nearest Charlestown, the dip of the syphon of the 30-inch pipe is twenty-nine feet, and the distance between arms is thirty-nine feet. At the northerly draw, the one nearest Chelsea, the dip is forty-two feet, five inches, and the distance between arms fifty feet.

It passes thence by the road near the shore to what was formerly Ober's wharf, now belonging to the City, and thence it passes across Chelsea Creek to EAST BOSTON. It is laid to the channel, from both sides of the creek, in a box filled with marsh mud or clay, and carried across the channel in a flexible jointed iron pipe of nearly double the ordinary thickness, with swivel joints. The flexible portion of the pipe is about four hundred and sixty-one feet long, laid in a trench dredged out about six feet deep, and covered with clay and gravel, to protect it from anchors.

This 20-inch pipe crosses Chelsea Creek, where it is 1,600 feet wide and about twenty-five feet deep in the channel at low water, and where vessels of large size pass. Mr. Wm. S. Whitwell, the engineer, adopted for this crossing the novel, ingenious and peculiar flange joint, flexible only in a perpendicular plane, but so secure as not to need a wooden frame to accompany the pipe. The adaptation of this joint to the purpose and its strength are quite admirable.

The distance between the joints is thirty-one feet, four inches; and each section consists of three pieces of 20-inch pipe, one inch and a half thick, and with flanges two inches thick, securely bolted together. These three pieces of pipe weigh together 3,300 lbs., and each joint weighs 3,800 lbs.; the size of the pipe being considerably enlarged at the joint.

The opposite sections of the joint meet on a perpendicular plane parallel with the portions of pipe on each side of the joint, and move upon a leather packing, which is placed in a groove between the two flanges.

One of the flanges is so much wider than the other as to have a cap ring bolted to it, which encloses and holds the other, and thus constitutes the joint. The strength of this arrangement is obvious, and its tightness has been tested by trial under a pressure of two hundred and fifty lbs. to the inch.

The jointed pipe for half the width of the channel was prepared on a staging, and sunk, after having been covered with a varnish to preserve it from the action of the brine.

It was sunk by being supported from a frame work and tackles above, while

the floor beneath it was removed, and it was then lowered down in the centre, the ends being retained above water for the purpose of connecting with the shore and the section which still remained to be sunk.

The other section was prepared and sunk in like manner, and thus was the connection established.

The total length of Main and Distributing Pipe laid up to January 1868, was 746,903 feet, equal to 141 miles, 2,423 feet.

## Service–Pipes.

The Service–Pipes are connected with the Distributing Pipes, and carried through the outer walls of the buildings, at the expense of the City, provided the distance from the line of the street is not more than three feet.

They are almost all of lead, and generally five-eighths of an inch in diameter; a few originally were of iron, an inch and a half and two inches diameter; but objections to pipes of that metal were so serious, arising from their filling up with accretions, discoloring the water with rust, and being easily fractured, their use has been discontinued: a few also are of block tin, where the owners of estates requested that it might be used, and were willing to pay the extra expense.

Some objection being made to the employment of lead for this purpose, the subject was submitted to the consideration of the Consulting Physicians, and investigations were made with great care by Professor Horsford, the particulars of which are given in Part III., Chapter XVII.

The total number of Service-pipes laid to May 1, 1867, was 26,201.

## Public Fountains.

At the present time, January 1868, there are twenty-one Public Fountains supplied with the Cochituate water, which are situated as follows:

One in the easterly end of the Pond on the Common.

One in the Pond in the Public Garden, which is supplied by the waste water from that on the Common.

Two are in the State House Yard.

One in Franklin Square.

" Blackstone "

" Chester "

" Lowell "

" Worcester "

" Concord "

" Haymarket "

Two in Union Park.
Six in the Public Garden.
One in Maverick Square, East Boston.
" Central " " "

There are also on the Common six "DRINKING FONTS."

All the fixtures connected with the several Fountains belong to the City, excepting those of the Fountains in front of the State House.

The Fountain on the Common is fitted with thirteen different jets, as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| Cross, | which discharges | 147,277 | gallons | per | hour. | |
| Solid, 6 in., | " | " | 173,267 | " | " | " |
| " 4 " | " | " | 94,509 | " | " | " |
| " 3 " | " | " | 63,917 | " | " | " |
| " 2 " | " | " | 28,520 | " | " | " |
| Lily, | " | " | 162,765 | " | " | " |
| Hollow, 10 in., | " | " | 127,890 | " | " | " |
| Wineglass, | " | " | 144,387 | " | " | " |
| Straight Hollow, | " | " | 48,901 | " | " | " |
| Self Acting, | " | " | 124,311 | " | " | " |
| Large Vase, | " | " | 46,200 | " | " | " |
| Small " | " | " | 2,200 | " | " | " |

The solid and hollow cylinder, straight jets of water, rise to the height of from seventy-five to ninety-eight feet.

The fancy jets rise to the height of from thirty to eighty feet.

As will be seen, the greatest consumption of water is from the solid 6-inch jet, which takes 173,267 gallons per hour; and the least consumption of water is that from the "small vase," which discharges 2,200 gallons per hour.

The fixtures of the Fountains at the State House and in Franklin and Blackstone squares are of cast-iron, in shape of an ornamental vase, supported on fluted columns. Those at the State House are about twelve feet high above the receiving basins, and those in the squares seven feet, nine inches. The water rises in these vases from three to seven feet. The fountain on the westerly side of the State House discharges 9,184 gallons per hour; that on the easterly side, 7,932 gallons; the one in Franklin Square, 1,814 gallons; and the one in Blackstone Square, 1,959 gallons.

The Chester Square Fountain is of iron, about twelve feet high, and con-

sists of three basins of five feet, two inches; three feet, ten inches; two feet, six inches diameter, respectively. It is surmounted with a pitcher, and has a sprinkling jet. This fountain discharges eight hundred and eighty gallons per hour.

The one in Lowell Square consists only of a jet nearly level with the basin, which discharges nine hundred and twenty-eight gallons per hour.

The Worcester Square Fountain is of iron, about eight feet, four inches high, and consists of two basins, four feet, six inches, and two feet, ten inches diameter, respectively; surrounded by figures; and discharges 1,234 gallons per hour.

The Haymarket Square Fountain consists of a stone pedestal about seven feet high, and two feet, six inches square, with jets on each side of the base, and is used as a drinking font. A street lamp post has been erected on the top of the pedestal.

The Union Park fountains are of iron, about seven feet, ten inches high, and consist respectively of a basin on a pedestal. The fountain at the easterly end discharges one hundred and forty-three gallons, and the westerly, one hundred and thirty-five gallons per hour.

Four of those in the Public Garden are only jets, and the fifth is of marble, representing the figure of Venus, with jets so arranged as to envelop it in spray. This statue was presented to the City by the late John D. Bates, Esq.

The discharge of the several fountains per hour is as follows: Small basin, five hundred and eighty-seven gallons; East basin, near Arlington Street, four hundred and sixty-two gallons; East basin, near Charles Street, five hundred and forty-four gallons; West basin, near Charles Street, one thousand one hundred and nineteen gallons; Venus jets, two thousand three hundred and seventy-one gallons.

Another fountain has also been erected here by private munificence, for the following description of which we are indebted to the politeness of Messrs. Ware and Van Brunt, architects of this City, after whose designs and under whose superintendence it was built:

The fountain on the Public Garden, in the axis of Marlborough Street, known as "the Ether Monument," is a gift to the City of Boston from the late Thomas Lee, Esq., and is erected as an expression of gratitude for the relief of human suffering by the discovery of the anæsthetic properties of ether, as well as to commemorate the fact that it was first publicly used in this City. The form of the monument is suggested by mediæval types, modified by the nature of the white Concord granite used in its construction. It is about

thirty feet in height, and arises from a square basin. Its base is cubical, having on each vertical face a niche containing a spouting lion's head with sculptured water lilies and other aquatic plants. Upon this base or plinth, rests a surbase, adorned with mouldings, from which arises a die, bearing upon each of its four sides an inscription, surmounted by a bas-relief in marble. These are sunk in the tympana of four pointed and cuspidated arches, supported each by two stunted shafts of red Gloucester granite, the capitals of which are enriched by poppies and oak leaves, this decoration being carried around the monument on the same level in a band or string course.

These arches form a canopy, square in plan, from which the structure diminishes by a series of mouldings to the base of a grouped quadripartite shaft of polished red granite. Its capital, which is decorated with oak leaves, bears on its abacus a group setting forth the story of "the good Samaritan," the type of the relief of suffering.

The inscriptions and bas-reliefs on the four sides are successively as follows:

I.

To commemorate
the discovery
that the inhaling of ether
causes insensibility to pain.
First proved to the world
at the Mass. General Hospital
in Boston
October A. D. MDCCCXLVI.

The bas-relief accompanying this represents a surgical operation in a civic hospital, the patient being under the influence of ether.

II.

Neither shall there be
any more pain. *Rev.*

With an allegorical bas-relief of the angel of mercy descending to relieve suffering humanity.

III.

In gratitude
for the relief
of human suffering
by the inhaling of ether,
a citizen of Boston
has erected
this monument.
A. D. MDCCCLXVII.

With a bas-relief of a field hospital, with a wounded soldier in the hands of the surgeons.

IV.

This also cometh forth
From the Lord of Hosts,
which is wonderful
in counsel
and excellent
in working. *Isaiah.*

The bas-relief accompanying this inscription is an allegory of the triumph of science.

The model for the crowning group is from the studio of Mr. J. Q. A. Ward, sculptor, of New York. It is executed in granite by Mr. Garrett Barry, of Quincy. The four marble bas-reliefs are also the work of Mr. Ward. Mr. Thomas Hollis, of Milton, was the contractor for the granite work, which was executed at the yard of Mr. D. C. Hutchinson, of this city. The masonry is by Mr. Martin L. Whitcher.

The Maverick Square Fountain is of iron, about five feet high, and consists of three basins, three feet, two inches; two feet, two inches; one foot, two inches diameter, respectively; surmounted by a sprinkling jet, and discharges one hundred and seventy-eight gallons per hour.

The Central Square Fountain is a simple jet nearly level with the stone basin, and discharges seven hundred and ninety-six gallons per hour.

The drinking fonts are situated as follows:

One near the corner of Park and Tremont streets,
" " " " " Beacon "
" " Great Elm on the Common.
" " West Street gate of the Common.
" " corner of Boylston and Charles streets.
" " " Charles and Beacon "

The discharge from these fonts averages thirty gallons per hour each.

## Cost of the Works to May 1st, 1867.

*Western Division.*

| | | |
|---|---|---|
| Amount paid William H. Knight, for the Lake | | $100,000 00 |
| " " " " " Factories, $50,000, less amount received on account of the sale of land and machinery, and insurance at the time of the fire | | 20,818 22 |
| Expense of raising the Lake two feet, including damages | | 28,002 18 |
| Cost of Roads, Bridges, and Swamps | | 38,332 48 |
| Gate House at the Lake | | 29,907 12 |
| Dam at the outlet of the Lake | | 8,458 20 |
| Dudley Pond, Lower Dam, and making connections with the Lake | | 18,982 23 |
| New Dam, and improvements at the Lake | | 12,647 97 |
| Total cost of the Lake Department, *not including land* | | $257,148 40 |
| Land and land damages, less credit, for land sold | $220,192 35 | |
| Constructing the Brick Conduit | 817,717 73 | |
| Brookline Reserv'r, Land $58,418 93 | | |
| " " Construction, 108,301 92 | 200,077 21 | |
| " " Gate House, 33,356 36 | | |
| Compensating Reservoirs, less amount received when sold | 66,859 80 | |
| Engineering Expenses on the Western Division | 68,370 56 | |
| Miscellaneous Expenses on the Western Division | 23,305 00 | |
| Payments on account of the Chestnut Hill Reservoir | 328,282 02 | 1,724,804 67 |
| Total cost of Western Division, | | $1,981,953 07 |

*Eastern Division.*

| | | | |
|---|---|---|---|
| Main and Service-Pipes . . . . | | $2,661,325 65 | |
| Beacon Hill Res'r, Land . . | $145,107 10 | 513,533 21 | |
| " " " Construction, | 368,426 11 | | |
| South Boston " Land . . | 55,103 23 | 90,908 10 | |
| " " " Construction, | 35,804 87 | | |
| East " " Land . . | 23,862 50 | 66,103 09 | |
| " " " Construction, | 42,240 59 | | |
| Engineering Expenses on the Eastern Division . . . . . | | 30,303 02 | |
| Machine Shop and Pipe Yards . . . | | 34,600 20 | |
| Hydrants and Stopcocks . . . . | | 51,747 65 | |
| Proving Pipes . . . . . | | 35,983 96 | |
| Meters . . . . . | | 90,902 07 | |
| Miscellaneous Expenses on the Eastern Division . . . . . | | 28,437 20 | |
| Total cost of Eastern Division, | | | $3,603,844 15 |
| Total cost of Western Division . . | | $1,981,953 07 | |
| " " Eastern . . . . | | 3,603,844 15 | |
| Total, Eastern and Western, | | | $5,585,797 22 |
| Expense of carrying on the Works . . | | $1,158,315 18 | |
| Interest paid, *after deducting total income received* . . . . . | | 370,596 74 | |
| Excess of Expenses and Interest over Income, | | | $1,528,911 92 |
| Total cost, on May 1st, 1867, over and above the Income, | | | $7,114,709 14 |

The foregoing Details and Statistics of our Publication not only sketch the Annals and Progress, but show the objects and course of the current Management of the great Popular convenience and necessity, the Public Water Works of the City of Boston.

May their Past success attend their Future.

FINIS.

# APPENDIX.

CONTAINING STATISTICAL INFORMATION AND TABLES WITH REGARD TO THE WATER WORKS.

# APPENDIX.

CIVIL ORGANIZATION OF THE WATER WORKS FROM THEIR COMMENCEMENT TO JANUARY 1ST, 1868.

*Water Commissioners.*

From May 4th, 1846, to January 4th, 1850:

Nathan Hale,
James F. Baldwin,
Thomas B. Curtis.

*Engineers for the Construction:*

John B. Jervis, of New York, *Consulting Engineer,*
From May 1846 to November 1848.

E. S. Chesbrough, *Chief Engineer of the Western Division,*
From May 1846, to January 4th, 1850.

William S. Whitwell, *Chief Engineer of the Eastern Division,*
From May 1846, to January 4, 1850.

*City Engineers having charge of the Works.*

E. S. Chesbrough, *Engineer,*
From January 4, 1850, to October 1, 1855.

H. S. McLean, *Assistant Engineer,*
From January 4th, 1850, to October 1st, 1855.

George H. Bailey, *Assistant Engineer,*
From January 4th, 1850, to October 1st, 1855.

James Slade, *Engineer,*
From October 1st, 1855, to April 1st, 1863.

N. Henry Crafts, *Assistant Engineer,*
From October 1st, 1855, to April 1st, 1863.

N. Henry Crafts, *City Engineer,*
From April 1st, 1863, to the present time.

T. W. Davis, *Assistant Engineer,*
From April 1st, 1863, to the present time.

Henry M. Wightman, *Resident Engineer at C. H. Reservoir,*
February 14th, 1866, to the present time.

After January 4th, 1850, Messrs. E. S. Chesbrough, W. S. Whitwell, and J. Avery Richards, were elected a WATER BOARD, subject to the direction of a JOINT STANDING COMMITTEE of the City Council, by an Ordinance passed December 31st, 1849, which was limited to continue in force one year; and in 1851 the COCHITUATE WATER BOARD was established.

## COCHITUATE WATER BOARD.

### PRESIDENTS OF THE BOARD.

| | |
|---|---|
| Thomas Wetmore, 1851 to 1856 | Five years. |
| John H. Wilkins, 1856 to 1860 | Four " |
| Ebenezer Johnson, 1860 to 1865 | Five " |
| Otis Norcross, 1865 to 1866 | One year and nine months. |
| John H. Thorndike, 1867 to 1868 | " " three " |

### MEMBERS OF THE BOARD.

| | |
|---|---|
| Thomas Wetmore, 1851, 52, 53, 54, 55 | Five years. |
| John H. Wilkins, 1851, 52, 53,* 56, 57, 58, 59 | Eight " |
| Henry B. Rogers, 1851, 52, 53, 54,* 55 | Five " |
| Jonathan Preston, 1851, 52, 53, 56 | Four " |
| James W. Sever, 1851 | One " |
| Samuel A. Eliot, 1851 | " " |
| John T. Heard, 1851 | " " |
| Adam W. Thaxter, jr., 1852, 53, 54, 55 | Four " |
| Sampson Reed, 1852, 53 | Two " |
| Ezra Lincoln, 1852 | One " |
| Thomas Sprague, 1853, 54, 55 | Three " |
| Samuel Hatch, 1854, 55, 56, 57, 58, 61 | Six " |
| Charles Stoddard,* 1854, 55, 56, 57 | Four " |
| William Washburn, 1854, 55 | Two " |
| Tisdale Drake, 1856, 57, 58, 59 | Four " |
| Thomas P. Rich, 1856, 57, 58 | Three " |
| John T. Dingley, 1856, 59 | Two " |
| Joseph Smith, 1856 | Two mos. |
| Ebenezer Johnson, 1857, 58, 59, 60, 61, 62, 63, 64 | Eight y'rs. |
| Samuel Hall, 1857, 58, 59, 60, 61 | Five " |
| Benjamin James, 1858 | One " |
| George P. French, 1859, 60, 61, 62, 63 | Five " |
| Ebenezer Atkins, 1859 | One " |

*Mr. John H. Wilkins resigned November 15th, 1854, and Charles Stoddard was elected to fill the vacancy. Mr. Henry B. Rogers resigned October 22d, 1865. Mr. Wilkins was re-elected February 1856, and chosen President of the Board, which office he held until his resignation on June 5th, 1860, when Mr. Ebenezer Johnson was elected President, and on July 2d, Mr. L. Miles Standish was elected to fill the vacancy occasioned by the resignation of Mr. Wilkins.

George Dennie, 1860, 61, 62, 63, 64, 65 ..... Six years.
Clement Willis, 1860 ..... One "
G. E. Pierce, 1860 ..... " "
Jabez Frederick, 1861, 62, 63 ..... Three "
George Hinman, 1862, 63 ..... Two "
John F. Pray, 1862 ..... One "
J. C. J. Brown, 1862 ..... " "
Jonas Fitch, 1864, 65, 66 ..... Three "
Otis Norcross, 1865, 66 ..... Two "
L. Miles Standish, 1860, 61, 63, 64, 65, 66, 67.
Nathaniel J. Bradlee, 1863, 64, 65, 66, 67–68.
Alexander Wadsworth, 1864, 65, 66, 67–68.
John H. Thorndike, 1864, 65, 66, 67.
Charles R. McLean, 1867.
Benjamin F. Stevens, 1866, 67.
William S. Hills, 1867.

# STATISTICAL TABLES.

## TABLE No. 1.

*Annual Amount of Rain-Fall, in Inches, at Lake Cochituate, Boston and vicinity,* 1849 *to* 1867, *inclusive.*

| YEAR. | PLACES AND OBSERVERS. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Lake Cochituate, by Supt. of Western Division, B. W. W. | Boston, by J. P. Hall, to 1865, by W. H. Bradley, since 1865. | Cambridge, by the Director of the Observatory. | Waltham, by E. Hobbs and J. R. Scott, Ag't Boston Manufacturing Co. | Lowell, by Merrimac Manufacturing Co. | Lowell, by Locks and Canals Co., J. B. Francis. | Providence, by A. Caswell. |
| 1849 | ..... | 40.30 | 40.97 | 40.74 | 51.09 | ..... | 34.69 |
| 1850 | ..... | 53.98 | 54.07 | 62.13 | 45.68 | ..... | 51.48 |
| 1851 | ..... | 44.31 | 41.97 | 41.00 | 41.00 | ..... | 43.30 |
| 1852 | * 45.93 | 47.94 | 40.51 | 42.24 | 42.78 | ..... | 38.58 |
| 1853 | * 55.86 | 48.86 | 53.83 | 45.04 | 43.92 | ..... | 53.27 |
| 1854 | 43.15 | 45.71 | 45.17 | 41.29 | 42.08 | ..... | 46.25 |
| 1855 | 34.96 | 44.19 | 47.59 | 40.63 | 44.89 | 48.41 | 39.05 |
| 1856 | 40.80 | 52.16 | 53.79 | 42.33 | 42.49 | 45.97 | 40.97 |
| 1857 | 63.10 | 56.87 | 57.92 | 44.04 | 49.38 | 52.02 | 44.74 |
| 1858 | 48.66 | 52.67 | 45.46 | 37.40 | 37.73 | 35.80 | 44.51 |
| 1859 | 49.02 | 56.70 | ..... | 48.49 | 47.51 | 48.41 | 45.29 |
| 1860 | 55.44 | 51.46 | 46.95 | ..... | 46.91 | 46.67 | 38.24 |
| 1861 | 46.44 | 50.07 | 50.14 | ..... | 43.32 | 42.95 | 44.25 |
| 1862 | 49.69 | 61.06 | 57.21 | ..... | 44.26 | 44.61 | 50.09 |
| 1863 | 69.30 | 67.72 | 56.42 | 53.66 | 52.37 | 57.81 | 54.17 |
| 1864 | 42.60 | 49.30 | ..... | 36.56 | 38.11 | 40.64 | 36.83 |
| 1865 | 49.46 | 47.83 | 43.59 | 35.84 | 37.38 | 38.82 | 44.69 |
| 1866 | 62.32 | 50.70 | ..... | 43.46 | 38.18 | 41.36 | 46.04 |
| 1867 | 56.25 | 55.64 | 41.71 | 41.40 | 45.54 | 45.87 | 47.04 |

* By J. Vannevar.

## TABLE No. 2.

*Statement showing Amount of Rain-Fall on Water-shed of Lake Cochituate, Amount of Water consumed and wasted, available Amount received into Lake, available percentage of Rain-Fall, etc., from 1852 to 1867, inclusive.*

| YEAR. | Rain-Fall. | Amount of Rain-Fall on Water-shed of Lake Cochituate. | Amount of Water consumed. | Amount of Water wasted from Lake. | Total am'nt consumed and wasted. | Rise of Lake during the year. | Fall of Lake during the year. | Total available amount of Rain-Fall received into Lake. | Available daily average am't of Rain-Fall rec'd into Lake. | Available per-cent'e of Rain-Fall rec'd into Lake. |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Inches.* | *Gallons.* | *Gallons.* | *Gallons.* | *Gallons.* | *Gallons.* | *Gallons.* | *Gallons.* | *Gallons.* | |
| 1852* | 47.93 | 15,759,207,000 | 2,947,042,800 | 4,020,566,885 | 6,994,609,685 | ..... | 261,360,000 | 6,733,249,685 | 18,396,857 | 43 per cent. |
| 1853 | 55.86 | 18,366,561,000 | 3,117,939,500 | 3,166,417,500 | 6,284,357,000 | 239,580,000 | ..... | 6,523,937,000 | 17,873,800 | 35 per cent. |
| 1854 | 43.15 | 14,187,562,000 | 3,614,230,000 | 4,187,733,020 | 7,801,963,020 | ..... | 217,800,000 | 7,584,163,020 | 20,778,529 | 53 per cent. |
| 1855 | 34.96 | 11,494,719,000 | 3,776,399,500 | No acc't kept. | ..... | ..... | 326,700,000 | ..... | ..... | ..... |
| 1856 | 40.80 | 13,414,892,000 | 4,409,787,600 | No acc't kept. | ..... | 598,950,000 | ..... | ..... | ..... | ..... |
| 1857 | 63.10 | 20,747,052,000 | 4,644,990,000 | 10,625,900,000 | 15,270,890,000 | 32,670,000 | ..... | 15,303,560,000 | 41,957,562 | 74 per cent. |
| 1858 | 48.66 | 15,999,232,000 | 4,689,155,000 | 1,934,500,000 | 6,623,655,000 | ..... | 141,570,000 | 6,482,085,000 | 17,759,013 | 40 per cent. |
| 1859† | 49.02 | 16,117,602,000 | 4,808,875,000 | 7,569,000,000 | 12,377,875,000 | 283,140,000 | ..... | 12,661,015,000 | 34,687,712 | 78 per cent. |
| 1860 | 55.44 | 18,228,471,000 | 6,309,108,000 | None. | 6,309,108,000 | 174,240,000 | ..... | 6,483,348,000 | 17,714,065 | 35 per cent. |
| 1861 | 46.44 | 15,269,303,000 | 6,639,095,900 | 3,377,558,966 | 10,016,654,866 | ..... | 1,459,260,000 | 8,557,394,866 | 23,444,917 | 56 per cent. |
| 1862 | 49.69 | 16,337,890,000 | 6,059,000,000 | 33,200,000 | 6,092,200,000 | 1,306,800,000 | ..... | 7,399,000,000 | 20,271,233 | 45 per cent. |
| 1863 | 69.30 | 22,785,586,000 | 5,927,052,500 | 2,165,696,470 | 8,092,748,970 | 762,300,000 | ..... | 8,855,048,970 | 24,260,408 | 39 per cent. |
| 1864 | 42.60 | 14,006,726,000 | 6,105,306,700 | 1,368,746,000 | 7,474,052,700 | ..... | 1,848,577,000 | 5,625,475,700 | 15,370,152 | 40 per cent. |
| 1865 | 49.46 | 16,262,266,000 | 4,621,630,000 | 1,688,120,674 | 6,309,750,674 | 743,242,500 | ..... | 7,052,973,174 | 19,323,270 | 43 per cent. |
| 1866 | 62.32 | 20,490,455,000 | 4,463,585,000 | None. | 4,463,585,000 | 743,242,500 | ..... | 5,206,827,500 | 14,265,280 | 25 per cent. |
| 1867 | 56.25 | 18,494,795,000 | 4,294,176,000 | 2,482,041,000 | 7,254,570,000 | ..... ..... | 698,811,000 | 6,555,759,000 | 17,961,000 | 35 per cent. |
| Average, 50.93 | | Aver. daily waste for 14 years .....8,340,400<br>" " " for 6 years, '52-59...14,378,900<br>" " " last 8 years, '60-67... 3,806,630 | | | Average daily capacity of Lake as a source of supply for 14 years, 21,716,700 | | | | | 46 p. ct. av. |

* Observations of Rain-Fall at Lake Cochituate commenced 1852, and these observations are assumed as correct for the whole district.

† Lake raised two feet.

## TABLE No. 3.

*Statement, showing the areas, and capacities in wine gallons, of Lake Cochituate, for each inch in height between a level of three feet, four inches above the bottom of the Conduit, and high water mark which is thirteen feet, four inches above the bottom of the Conduit.*

| Heights above bottom of Conduit. | Area in acres. | Capacities, in wine gallons, for each inch in height. | Total capacities, in wine gallons. | Heights above bottom of Conduit. | Area in acres. | Capacities, in wine gallons, for each inch in height. | Total capacities, in wine gallons. | Heights above bottom of Conduit. | Area in acres. | Capacities, in wine gallons, for each inch in height. | Total capacities, in wine gallons. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 feet 4 inches. | 489 | . . . . . | . . . . . | 5 feet 0 inches. | 510 | 13,803,000 | 270,834,000 | 6 feet 8 inches. | 568 | 15,409,000 | 564,129,000 |
| " 5 " | 490 | 13,313,000 | 13,313,000 | " 1 " | 513 | 13,885,000 | 284,719,000 | " 9 " | 571 | 15,464,000 | 579,593,000 |
| " 6 " | 491 | 13,340,000 | 26,653,000 | " 2 " | 516 | 13,966,000 | 298,685,000 | " 10 " | 573 | 15,545,000 | 595,139,000 |
| " 7 " | 492 | 13,367,000 | 40,021,000 | " 3 " | 519 | 14,048,000 | 312,734,000 | " 11 " | 576 | 15,600,000 | 610,738,000 |
| " 8 " | 493 | 13,395,000 | 53,415,000 | " 4 " | 522 | 14,130,000 | 326,863,000 | 7 feet 0 " | 578 | 15,682,000 | 626,420,000 |
| " 9 " | 494 | 13,422,000 | 66,837,000 | " 5 " | 525 | 14,211,000 | 341,075,000 | " 1 " | 580 | 15,736,000 | 642,156,000 |
| " 10 " | 494 | 13,449,000 | 80,287,000 | " 6 " | 528 | 14,293,000 | 355,368,000 | " 2 " | 583 | 15,791,000 | 657,947,000 |
| " 11 " | 495 | 13,449,000 | 93,736,000 | " 7 " | 531 | 14,375,000 | 369,743,000 | " 3 " | 585 | 15,872,000 | 673,819,000 |
| 4 feet 0 " | 496 | 13,476,000 | 107,212,000 | " 8 " | 534 | 14,456,000 | 384,199,000 | " 4 " | 588 | 15,927,000 | 689,745,000 |
| " 1 " | 497 | 13,504,000 | 120,716,000 | " 9 " | 537 | 14,538,000 | 398,738,000 | " 5 " | 590 | 16,008,000 | 705,754,000 |
| " 2 " | 498 | 13,531,000 | 134,246,000 | " 10 " | 540 | 14,620,000 | 413,357,000 | " 6 " | 592 | 16,063,000 | 721,816,000 |
| " 3 " | 499 | 13,558,000 | 147,805,000 | " 11 " | 543 | 14,702,000 | 428,059,000 | " 7 " | 595 | 16,117,000 | 737,934,000 |
| " 4 " | 499 | 13,585,000 | 161,390,000 | 6 feet 0 " | 547 | 14,783,000 | 442,842,000 | " 8 " | 597 | 16,199,000 | 754,133,000 |
| " 5 " | 500 | 13,585,000 | 174,975,000 | " 1 " | 550 | 14,892,000 | 457,734,000 | " 9 " | 600 | 16,253,000 | 770,386,000 |
| " 6 " | 501 | 13,613,000 | 188,588,000 | " 2 " | 553 | 14,974,000 | 472,708,000 | " 10 " | 602 | 16,335,000 | 786,721,000 |
| " 7 " | 502 | 13,640,000 | 202,227,000 | " 3 " | 556 | 15,055,000 | 487,763,000 | " 11 " | 604 | 16,389,000 | 803,110,000 |
| " 8 " | 503 | 13,667,000 | 215,894,000 | " 4 " | 559 | 15,137,000 | 502,900,000 | 8 feet 0 " | 607 | 16,444,000 | 819,554,000 |
| " 9 " | 504 | 13,694,000 | 229,588,000 | " 5 " | 561 | 15,219,000 | 518,119,000 | " 1 " | 609 | 16,526,000 | 836,080,000 |
| " 10 " | 504 | 13,721,000 | 243,310,000 | " 6 " | 563 | 15,273,000 | 533,392,000 | " 2 " | 612 | 16,580,000 | 852,660,000 |
| " 11 " | 507 | 13,721,000 | 257,031,000 | " 7 " | 566 | 15,328,000 | 548,720,000 | " 3 " | 614 | 16,662,000 | 869,321,000 |

## TABLE No. 3.— *Continued.*

| Heights above bottom of Conduit. | Area in acres. | Capacities, in wine gallons, for each inch in height. | Total capacities, in wine gallons. | Heights above bottom of Conduit. | Area in acres. | Capacities, in wine gallons, for each inch in height. | Total Capacities, in wine gallons. | Heights above bottom of Conduit. | Area in acres. | Capacities, in wine gallons, for each inch in height. | Total capacities, in wine gallons. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 feet 4 inches. | 616 | 16,716,000 | 886,038,000 | 10 feet 1 inch. | 664 | 18,023,000 | 1,252,051,000 | 11 feet 9 inches. | 709 | 19,194,000 | 1,621,739,000 |
| " 5 " | 619 | 16,771,000 | 902,808,000 | " 2 " | 665 | 18,077,000 | 1,270,128,000 | " 10 " | 714 | 19,303,000 | 1,641,041,000 |
| " 6 " | 621 | 16,852,000 | 919,661,000 | " 3 " | 667 | 18,105,000 | 1,288,326,000 | " 11 " | 719 | 19,439,000 | 1,660,471,000 |
| " 7 " | 624 | 16,907,000 | 936,567,000 | " 4 " | 668 | 18,159,000 | 1,306,392,000 | 12 feet 0 " | 724 | 19,575,000 | 1,680,055,000 |
| " 8 " | 626 | 16,988,000 | 953,556,000 | " 5 " | 669 | 18,186,000 | 1,324,578,000 | " 1 " | 728 | 19,711,000 | 1,699,766,000 |
| " 9 " | 628 | 17,043,000 | 970,598,000 | " 6 " | 671 | 18,214,000 | 1,342,791,000 | " 2 " | 733 | 19,820,000 | 1,719,585,000 |
| " 10 " | 631 | 17,097,000 | 987,696,000 | " 7 " | 672 | 18,268,000 | 1,361,059,000 | " 3 " | 738 | 19,956,000 | 1,739,541,000 |
| " 11 " | 633 | 17,179,000 | 1,004,875,000 | " 8 " | 673 | 18,295,000 | 1,379,355,000 | " 4 " | 743 | 20,092,000 | 1,759,633,000 |
| 9 feet 0 " | 635 | 17,233,000 | 1,022,108,000 | " 9 " | 675 | 18,322,000 | 1,397,677,000 | " 5 " | 748 | 20,228,000 | 1,779,862,000 |
| " 1 " | 638 | 17,288,000 | 1,039,396,000 | " 10 " | 676 | 18,377,000 | 1,416,054,000 | " 6 " | 753 | 20,364,000 | 1,800,226,000 |
| " 2 " | 640 | 17,370,000 | 1,056,766,000 | " 11 " | 678 | 18,404,000 | 1,434,458,000 | " 7 " | 758 | 20,500,000 | 1,820,726,000 |
| " 3 " | 643 | 17,424,000 | 1,074,190,000 | 11 feet 0 " | 679 | 18,459,000 | 1,452,917,000 | " 8 " | 763 | 20,637,000 | 1,841,363,000 |
| " 4 " | 645 | 17,506,000 | 1,091,695,000 | " 1 " | 681 | 18,486,000 | 1,471,402,000 | " 9 " | 767 | 20,773,000 | 1,862,136,000 |
| " 5 " | 648 | 17,560,000 | 1,109,255,000 | " 2 " | 682 | 18,540,000 | 1,489,943,000 | " 10 " | 772 | 20,882,000 | 1,883,017,000 |
| " 6 " | 650 | 17,642,000 | 1,126,897,000 | " 3 " | 684 | 18,567,000 | 1,508,510,000 | " 11 " | 777 | 21,018,000 | 1,904,035,000 |
| " 7 " | 652 | 17,696,000 | 1,144,593,000 | " 4 " | 685 | 18,622,000 | 1,527,132,000 | 13 feet 0 " | 782 | 21,154,000 | 1,925,189,000 |
| " 8 " | 655 | 17,751,000 | 1,162,344,000 | " 5 " | 690 | 18,649,000 | 1,545,781,000 | " 1 " | 787 | 21,290,000 | 1,946,479,000 |
| " 9 " | 657 | 17,832,000 | 1,180,176,000 | " 6 " | 695 | 18,785,000 | 1,564,566,000 | " 2 " | 792 | 21,426,000 | 1,967,905,000 |
| " 10 " | 660 | 17,887,000 | 1,198,063,000 | " 7 " | 700 | 18,921,000 | 1,583,488,000 | " 3 " | 797 | 21,562,000 | 1,989,467,000 |
| " 11 " | 661 | 17,969,000 | 1,216,032,000 | " 8 " | 705 | 19,058,000 | 1,602,545,000 | " 4 " | 801 | 21,698,000 | 2,011,165,000 |
| 10 ft. 0 " | 662 | 17,996,000 | 1,234,028,000 | | | | | | | | |

## TABLE No. 4.

*Table of the average monthly and yearly heights of water in the Lake above the bottom of the Aqueduct.*

| MONTHS. | 1851. | 1852. | 1853. | 1854. | 1855. | 1856. | 1857. | 1858. | 1859.* | 1860. | 1861. | 1862. | 1863. | 1864. | 1865. | 1866. | 1867. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 9.50 | 10.63 | 9.51 | 10.54 | 10.16 | 8.06 | 9.53 | 10.75 | 10.80 | 10.83 | 11.93 | 6.09 | 11.33 | 13.88 | 7.41 | 8.37 | 12.14 |
| February | 10.21 | 10.20 | 10.78 | 10.95 | 10.65 | 7.59 | 10.28 | 10.05 | 12.17 | 11.36 | 12.77 | 6.57 | 12.85 | 13.71 | 8.24 | 8.73 | 13.14 |
| March | 10.43 | 10.49 | 10.44 | 10.93 | 10.68 | 6.96 | 10.67 | 9.35 | 12.45 | 12.67 | 13.21 | 8.65 | 13.95 | 14.33 | 12.28 | 10.58 | 13.57 |
| April | 11.17 | 11.23 | 10.68 | 10.66 | 11.57 | 10.24 | 12.30 | 9.36 | 12.06 | 12.72 | 14.14 | 12.40 | 14.59 | 14.32 | 14.00 | 11.96 | 13.50 |
| May | 11.02 | 10.94 | 10.98 | 10.87 | 11.35 | 12.05 | 12.05 | 10.67 | 12.06 | 11.52 | 13.88 | 14.45 | 14.01 | 14.26 | 14.00 | 12.01 | 13.44 |
| June | 10.40 | 10.28 | 10.62 | 10.33 | 10.69 | 11.78 | 12.14 | 11.72 | 11.96 | 10.83 | 12.99 | 14.43 | 13.29 | 13.51 | 13.41 | 12.72 | 13.20 |
| July | 9.76 | 9.44 | 9.45 | 9.00 | 9.86 | 10.67 | 11.41 | 11.74 | 10.22 | 10.42 | 11.50 | 14.05 | 12.82 | 11.33 | 12.28 | 11.84 | 12.12 |
| August | 9.01 | 8.40 | 8.64 | 6.67 | 9.01 | 11.59 | 11.70 | 11.30 | 10.24 | 9.42 | 10.27 | 12.97 | 13.73 | 9.65 | 11.18 | 11.79 | 12.17 |
| September | 8.00 | 5.68 | 7.78 | 6.64 | 7.52 | 10.82 | 11.72 | 10.40 | 9.84 | 9.42 | 8.71 | 11.33 | 13.43 | 7.91 | 10.09 | 11.59 | 12.00 |
| October | 7.55 | 6.55 | 7.34 | 5.90 | 6.42 | 10.10 | 11.10 | 8.72 | 10.15 | 10.35 | 7.79 | 10.30 | 12.94 | 6.46 | 9.02 | 11.72 | 11.10 |
| November | 8.07 | 7.74 | 9.58 | 6.09 | 6.28 | 10.80 | 11.16 | 9.01 | 9.98 | 10.44 | 7.22 | 10.24 | 13.26 | 5.48 | 8.74 | 11.41 | 11.03 |
| December | 9.67 | 8.49 | 10.57 | 8.38 | 7.29 | 10.97 | 11.02 | 9.85 | 10.54 | 11.17 | 6.88 | 11.70 | 14.06 | 5.41 | 8.48 | 11.68 | 10.51 |
| Yearly averages | 9.57 | 9.17 | 9.70 | 9.00 | 9.29 | 10.14 | 11.26 | 10.24 | 11.04 | 10.93 | 10.94 | 11.10 | 13.52 | 10.84 | 10.76 | 11.20 | 12.33 |

* High-water mark raised two feet.

TABLE No. 5.

The following Statement shows the amount of water that ran over the Outlet Dam during the year 1867:

| Month. | No. of Days. | No. of Wine Gallons. |
|---|---|---|
| February | 20 | 956,216,492 |
| March | 26 | 562,377,743 |
| April | 25 | 678,461,904 |
| May | 21 | 284,985,224 |
| Total | 92 | 2,482,041,363 |

TABLE No. 6.

DISTANCES BETWEEN DIFFERENT POINTS OF THE WATER WORKS.

| | |
|---|---|
| From the Gate House at the Lake, to the Waste Weir at Dedman's Brook. — Sec. 3 | 15,870 feet, |
| Thence, to the Waste Weir, in Sec. 6 | 19,011 " |
| Thence, to the Pipe Chamber, West side of Charles River | 6,167 " |
| Thence, across Charles River, to East Pipe Chamber | 1,095 " |
| Thence, to the Waste Weir, in Sec. 10 | 15,025 " |
| Thence, through Newton Tunnel, 2,410 feet, to the Ventilator | 7,308 " |
| Thence, to the Waste Weir, in Sec. 13 | 8,650 " |
| Thence, through Brookline Tunnel, 1,150 feet, to Brookline Reservoir | 4,103 " |
| Thence, to the Gate House, at the East end of the Reservoir | 2,000 " |
| Thence, to Dover Street | 19,625 " |
| Thence, to the Fountain on the Common | 4,073 " |
| Thence, to Beacon Hill Reservoir | 1,200 " |
| Thence, to East Boston Reservoir | 20,129 " |
| From Dover Street, to South Boston Reservoir | 8,570 " |
| From the Lake, to East end of Brookline Reservoir | 15.005 miles. |
| From Brookline Reservoir, to Fountain on the Common | 4.488 " |
| From Brookline Reservoir, to Beacon Hill Reservoir | 5.094 " |
| From Brookline Reservoir, to East Boston Reservoir | 8.528 " |
| From Brookline Reservoir, to South Boston Reservoir | 5.350 " |
| From the Gate House at the Lake, to the Chestnut Hill Reservoir, Lower Gate House | 13.596 " |
| From the Chestnut Hill Reservoir Gate House, to the Brookline Gate House, in an air line | 1.182 " |

TABLE No. 7.

## HEIGHTS OF IMPORTANT POINTS ABOVE TIDE MARSH LEVEL.

| | |
|---|---|
| Floor of Knight's Flume | 124.36 feet. |
| Low Water Mark, Lake Cochituate | 124.86 " |
| High " " " " | 134.36 " |
| Bottom of interior of Aqueduct, at Lake Cochituate | 121.00 " |
| " " " West Pipe Chamber | 118.97 " |
| " " " East " " | 118.52 " |
| " " " Brookline Reservoir | 116.77 " |
| " Brookline Reservoir | 100.60 " |
| Upper floor of Brookline Gate House | 126.76 " |
| Low Water Mark, Brookline Reservoir | 120.60 " |
| Top of Dam of " " | 126.60 " |
| Bottom of Beacon Hill Reservoir | 108.03 " |
| Top " " " Coping (outside) | 124.03 " |
| Bottom " " " Waste Weir | 121.53 " |
| " South Boston " | 105.35 " |
| Top " " " Dam | 125.86 " |
| Bottom of East Boston " | 80.60 " |
| Top " " " Dam | 110.60 " |
| State House Floor | 106.94 " |
| Coping of Charlestown Dry Dock | 5.09 " |
| Gate House Floor, at Lake | 138.10 " |
| Bottom of interior of Aqueduct, at the Intermediate Gate House, Chestnut Hill Reservoir | 117.17 " |
| Top of Dam, at Chestnut Hill Reservoir | 128.00 " |
| High Water Mark, " " " | 125.00 " |
| Lower Floor of Intermediate Gate House, C. H. R. | 110.00 " |
| Upper " " " " " | 128.42 " |
| Lower " Effluent " " " | 99.00 " |
| Upper " " " " " | 128.42 " |
| Interior Bottom of Pipe, at Effluent Gate House, C. H. R. | 100.00 " |

## Table No. 8.

## LEVELS OF DOOR-SILLS.

The following levels of Door-sills, in different sections of the City, are given below, that those who may have occasion to know can ascertain, by comparison, the levels to which the Cochituate water will rise in the pipes on their premises.

The levels are given in feet and hundredths of a foot, above TIDE MARSH LEVEL, the standard bench or level adopted on the line of the works, and which is $5\frac{9}{100}$ feet below the coping of the dry dock, in the Charlestown Navy Yard.

### Elevation of Door-Sills above Tide Marsh Level.

*Boston Proper.*

| Street. | No. | Elevation. | Remarks. |
|---|---|---|---|
| Causeway Street | | 7.18 | Fitchburg Depot. |
| " " | | 8.27 | Eastern Depot. |
| " " | | 10.37 | Lowell Depot. |
| Lowell Street | | 9.96 | Barton House, corner Minot Street. |
| Merrimac Street | | 7.71 | Merrimac House, corner Friend Street. |
| Haymarket Square | | 10.35 | Boston and Maine Depot. |
| Cross Street | | 8.36 | Massachusetts House, corner Endicott Street. |
| Salem Street | 107 | 16.07 | Near Cooper. |
| " " | 112 | 13.59 | Near Prince Street. |
| " " | 135 | 15.64 | " " " |
| Hull Street | 4 | 30.69 | Near Salem Street. |
| " " | 40 | 47.32 | |
| " " | 52 | 51.35 | Corner Snowhill Street. |
| Sheafe Street | 42 | 32.81 | " " " |
| Prince Street | 120 | 11.31 | Near " " |
| Hanover Street | 382 | 17.90 | Webster House. |
| " " | 359 | 19.57 | Pavilion. |
| " " | 345 | 20.73 | Trimountain House. |
| " " | 181 | 12.60 | Blackstone House. |
| " " | | 15.76 | American House. |
| North Square | 1 | 24.01 | Neptune House. |
| Blackstone Street | | 8.04 | New England House, corner Clinton Street. |
| Faneuil Hall Square | | 8.13 | Market Floor. |
| North Market Street | | 9.00 | Quincy Market. |
| Brattle Street | | 14.29 | City Hotel. |
| " " | | 17.40 | Quincy House, corner Brattle Square. |
| Elm Street | | 10.20 | Wilde's Hotel. |
| Howard Street | | 37.84 | Howard Athenæum. |
| Bowdoin Square | | 38.36 | Revere House. |

| Street. | No. | Elevation. | Remarks. |
|---|---|---|---|
| Bowdoin Street | 48 | 87.91 | |
| " " | 50 | 95.01 | |
| " " | 52 | 94.96 | |
| " " | 54 | 94.79 | |
| " " | 56 | 94.73 | |
| Ashburton Place | 3 | 84.96 | |
| " " | 4 | 85.05 | |
| " " | 5 | 85.03 | |
| " " | 6 | 86.11 | |
| " " | 8 | 86.03 | |
| " " | 9 | 85.08 | |
| " " | 10 | 88.53 | |
| " " | 12 | 89.67 | |
| " " | 14 | 89.73 | |
| " " | 16 | 88.45 | |
| " " | 17 | 88.11 | |
| " " | 18 | 87.87 | |
| " " | 20 | 87.86 | |
| " " | 22 | 87.89 | |
| Somerset Street | 13 | 81.15 | |
| " " | 19 | 72.80 | |
| " " | 21 | 69.72 | |
| Pemberton Square | 12 | 63.25 | |
| " " | 13 | 63.26 | |
| " " | 19 | 63.24 | |
| " " | 20 | 71.74 | |
| " " | 21 | 69.75 | |
| " " | 23 | 63.43 | |
| " " | 24 | 63.42 | |
| " " | 25 | 63.43 | |
| " " | 26 | 63.47 | |
| " " | 27 | 64.87 | |
| Beacon Hill Place | 3 | 100.87 | |
| Park Street | 5 | 63.07 | |
| " " | 9 | 67.79 | |
| " " | | 78.99 | Corner Beacon Street. |
| Mount Vernon Street | 2 | 97.96 | |
| " " " | 3 | 87.75 | |
| " " " | 7 | 91.27 | |
| " " " | 9 | 93.00 | |
| " " " | 10 | 98.13 | |
| " " " | 15 | 98.17 | |
| " " " | 16 | 102.36 | |
| " " " | 19 | 100.08 | |
| " " " | 21 | 100.09 | |
| " " " | 23 | 99.25 | |

| Street. | No. | Elevation. | Remarks. |
|---|---|---|---|
| Mount Vernon Street | 25 | 99.88 | |
| " " " | 26 | 99.70 | |
| " " " | 29 | 100.71 | |
| " " " | 31 | 97.55 | |
| " " " | 32 | 90.58 | |
| " " " | 33 | 100.16 | |
| " " " | 39 | 99.44 | |
| " " " | 45 | 99.14 | |
| " " " | 49 | 103.37 | |
| " " " | 51 | 100.45 | |
| " " " | 53 | 99.75 | |
| " " " | 57 | 100.43 | |
| " " " | 58 | 74.66 | |
| " " " | 59 | 100.46 | |
| " " " | 69 | 96.42 | |
| " " " | 71 | 96.45 | |
| " " " | 73 | 94.97 | |
| " " " | 75 | 92.15 | |
| " " " | 77 | 90.73 | |
| " " " | 81 | 89.18 | |
| " " " | 83 | 89.14 | |
| " " " | 87 | 79.09 | |
| " " " | 89 | 77.67 | |
| Beacon Street | 4 | 58.76 | |
| " " | 7 | 70.43 | |
| " " | 9 | 73.65 | |
| " " | 11 | 73.62 | |
| " " | 13 | 75.32 | |
| " " | 21 | 83.93 | |
| " " | 23 | 83.45 | |
| " " | 24 | 79.71 | |
| " " | 25 | 85.27 | |
| " " | 27 | 86.72 | |
| " " | 29 | 80.08 | |
| " " | 31 | 78.39 | |
| " " | 35 | 69.64 | |
| " " | 36 | 69.22 | |
| Mount Vernon Place | 2 | 100.04 | |
| " " " | 3 | 98.88 | |
| " " " | 6 | 96.71 | |
| " " " | 8 | 94.45 | |
| Hancock Avenue | 2 | 94.98 | |
| " " | 4 | 89.89 | |
| " " | 6 | 84.19 | |
| Hancock Street | 57 | 86.91 | |
| " " | 63 | 93.06 | |

| Street. | No. | Elevation. | Remarks. |
|---|---|---|---|
| Chestnut Street | 5 | 74.41 | |
| Joy Street | 1 | 83.59 | |
| " " | 3 | 89.62 | |
| " " | 5 | 93.63 | |
| " " | 6 | 97.00 | |
| Myrtle Street | 32 | 82.36 | |
| Pinckney Street | 2 | 88.80 | |
| " " | 9 | 90.49 | |
| " " | 11 | 90.50 | |
| " " | 12 | 92.31 | |
| " " | 42 | 97.78 | |
| " " | 45 | 95.32 | |
| " " | 46 | 99.08 | |
| " " | 48 | 94.46 | |
| " " | 58 | 94.36 | |
| " " | 60 | 89.59 | |
| Court Square | | 34.35 | Hancock House. |
| Cornhill Court | | 31.64 | Young's Hotel, dining-room floor. |
| School Street | | 45.14 | City Hall, first floor. |
| " " | | 48.00 | Parker House, dining-room floor. |
| Tremont Street | | 52.60 | Tremont House, piazza platform. |
| " " | | 52.65 | Horticultural Hall, lower door. |
| " " | | 30.79 | Evans House. |
| " " | | 7.77 | Clarendon House. |
| " " | 510 | 11.25 | |
| " " | | 10.00 | Smith's Organ Factory. |
| " " | 647 | 9.01 | |
| " " | 657 | 11.49 | |
| " " | 660 | 14.95 | |
| " " | 699 | 7.07 | |
| Bromfield Street | | 42.38 | Bromfield House. |
| Washington Street | | 28.32 | Marlboro' Hotel. |
| " " | | 20.90 | Adams House. |
| " " | 1,498 | 7.50 | |
| " " | 1,525 | 6.03 | |
| " " | 1,544 | 7.52 | |
| " " | | 9.50 | Everett House, corner Camden Street. |
| " " | 1,622 | 12.84 | |
| Boylston Street | | 22.54 | Hotel Pelham. |
| " " | 124 | 13.32 | Near Berkeley Street. |
| " " | 142 | 13.21 | " " " |
| Beach Street | | 9.71 | Corner Harrison Avenue, Boston Hotel. |
| " " | | 6.89 | Boston and Albany Railroad Depot. |
| " " | | 12.01 | United States Hotel, piazza platform. |
| Kneeland Street | | 7.91 | Old Colony and Newport Railroad Depot. |

| Street. | No. | Elevation. | Remarks. |
|---|---|---|---|
| Shawmut Avenue . . | 247 | 13.72 | |
| " " . . | 244 | 13.39 | |
| " " . . | 236 | 8.49 | |
| Newton Street. . . | | 8.86 | St. James Hotel. |

## Elevation of Door-Sills above Tide Marsh Level.

### *South Boston.*

| | | | |
|---|---|---|---|
| Broadway . . . | 65 | 25.93 | |
| " . . | 74 | 24.92 | |
| " . . | 81 | 22.08 | |
| " . . . | 157 | 14.29 | |
| " . . . | 176 | 13.49 | |
| " . . . | 185 | 13.19 | |
| " . | 219 | 26.92 | |
| " . . . | 237 | 38.69 | |
| " | 282 | 42.72 | |
| " . . . | 306 | 48.93 | |
| " . . | 376 | 82.96 | |
| " . . . | 382 | 83.37 | |
| " . . . | 363 | 90.97 | |
| " . . | 412 | 79.71 | |
| " . . | 472 | 37.00 | |
| " . . | | 32.81 | Broadway Horse Railroad Stables. |
| Fourth Street . . . | 178 | 13.05 | |
| " " . | 195 | 13.02 | |
| " " . . . | 301 | 15.63 | |
| " " . . | 683 | 36.92 | Corner K Street. |
| " " . . . | 748 | 41.12 | |
| " " . . . | 764 | 40.98 | |
| " " . . . | | 33.30 | Southwest corner P Street. |

## Elevation of Door-Sills above Tide Marsh Level.

### *East Boston.*

| | | | |
|---|---|---|---|
| White Street . . . | | 82.62 | Opposite Monmouth Street, D. McKay's house. |
| " " . . . | | 74.40 | Corner Monmouth, Stevens' house. |
| Brooks Street . . . | 88 | 58.27 | Corner Eutaw Street. |
| Trenton Street . . | 94 | 51.95 | Near Brooks Street. |
| Bennington Street . . | | 14.69 | Corner Brooks. |
| Chelsea Street . . | | 6.74 | Atlantic Works. |
| " " . . | | 13.19 | Engine House, near Bennington Street. |
| " " . . | | 12.18 | Maverick Oil Works. |
| Saratoga Street . . | | 22.34 | Corner Pope Street, New England Pipe Works. |
| " " . . | 76 | 13.86 | Corner Marion Street. |
| " " . . | 64 | 14.13 | |
| " " . . | 46 | 12.57 | |

| Street. | No. | Elevation. | Remarks. |
|---|---|---|---|
| Meridian Street . . | | 7.56 | Northerly corner London Street. |
| " " . . | 93 | 7.68 | Northerly corner Havre Street. |
| " " . . | | 10.78 | Near Paris Street, Police Station. |
| " " . . | 25 | 8.59 | |
| " " . . | | 13.79 | Maverick House. |
| Lewis Street . . . | 2 | 10.16 | |
| Webster Street . . | 117 | 60.99 | |
| " " . . | 124 | 57.94 | |

## Elevation of Door-Sills above Tide Marsh Level.

### *Roxbury District.*

| | | |
|---|---|---|
| Highland Street . . | 120.99 | Southerly cor. Beach Street, S. C. Thwing's house |
| " " . . | 139.86 | Northerly cor. Fort Avenue, Benj. Perkins' house. |
| " " . . | 125.79 | J. H. Eastburn's house. |
| " " . . | 117.04 | Rev. Dr. Putnam's house. |
| " " . . | 117.31 | Sam'l C. Cobb's house. |
| " " . . | 116.43 | E. Harrington's house. |
| " " . . | 132.17 | W. S. Garrison's house. |
| " " . . | 109.60 | G. E. Simmons' house. |
| " " . . | 106.62 | G. & H. Dunbar's house. |
| " " . . | 95.17 | Mrs. E. Appleton's house. |
| Dudley Street. . . | 66.18 | Norfolk House. |
| Linwood Place . . | 125.45 | Thomas Flint. |
| Fort Avenue . . . | 146.94 | Dr. Morrill. |
| " " . . . | 148.81 | Hunnewell's house. |
| Shawmut Avenue . . | 30.60 | Corner Bartlett Street, Dr. H. Bartlett. |
| Alpine Street . . | 102.81 | Henry Hale, opposite Akron Street. |
| " " . . . | 111.11 | J. McInness, corner Akron Street. |
| Akron Street . . . | 112.36 | Folsom. |
| Alpine Street . . . | 117.33 | Henry S. Hall. |

The average heights of water in the several Reservoirs, above tide marsh level, are as follows:

Brookline Reservoir, 123 feet; Beacon Hill, 117 feet.
South Boston, 112 " East Boston, 93 "
The estimated average for the Roxbury District, 118 feet.

N. B. — The pressure of water at the temperature of sixty-two degrees F. is $43\frac{4}{10}$ pounds upon a superficial inch, for every one hundred feet in height.

A column of water $33\frac{86}{100}$ feet high is equal to the pressure of the atmosphere at the level of the sea, or $14\frac{69}{100}$ pounds per square inch.

It should be understood, that practically, the water will not rise in the Service pipes so high as it rises in the several Reservoirs as above stated, the "head" being affected more or less by friction and the varying draughts of the consumers. See tests of heights of rise, page 167.

## Table No. 9.

*Average monthly Heights of Water in Reservoirs at Brookline, Beacon Hill, South and East Boston,* 1861–67 *inclusive.*

| | BROOKLINE. | | | | | | | BEACON HILL. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month. | 1861. | 1862. | 1863. | 1864. | 1865. | 1866. | 1867. | 1861. | 1862. | 1863. | 1864. | 1865. | 1866. | 1867. |
| January | 122.81 | 122.46 | 123.64 | 122.37 | 123.31 | 122.28 | 122.00 | 116.61 | 117.48 | 118.36 | 117.72 | 119.18 | 119.20 | 119.11 |
| Febru'ry | 122.68 | 122.85 | 123.23 | 122.61 | 122.82 | 122.47 | 123.12 | 118.93 | 119.46 | 118.18 | 117.54 | 118.91 | 119.65 | 118.59 |
| March . | 123.32 | 123.52 | 123.23 | 123.62 | 123.26 | 123.19 | 123.05 | 119.05 | 119.18 | 118.03 | 116.38 | 120.58 | 120.72 | 119.45 |
| April . . | 124.01 | 124.18 | 123.85 | 123.82 | 123.38 | 123.45 | 123.00 | 118.91 | 117.91 | 117.27 | 117.21 | 121.28 | 120.70 | 119.86 |
| May . . . | 124.04 | 124.00 | 123.52 | 123.62 | 122.65 | 123.04 | 123.07 | 119.06 | 117.59 | 116.33 | 116.53 | 120.31 | 119.53 | 118.50 |
| June . . | 123.68 | 123.25 | 123.17 | 122.66 | 123.23 | 123.29 | 122.34 | 117.32 | 116.39 | 115.40 | 115.31 | 120.56 | 118.53 | 118.34 |
| July . . . | 122.68 | 123.73 | 122.76 | 122.87 | 123.33 | 122.97 | 122.98 | 116.48 | 116.46 | 116.34 | 115.32 | 121.23 | 119.51 | 119.00 |
| August. | 123.71 | 123.70 | 123.11 | 122.64 | 123.39 | 122.80 | 122.23 | 114.18 | 116.22 | 116.05 | 115.19 | 119.83 | 119.17 | 117.70 |
| Sept. . . | 123.76 | 123.64 | 123.36 | 122.03 | 123.29 | 122.81 | 122.52 | 113.14 | 116.22 | 116.12 | 115.91 | 119.03 | 119.39 | 120.46 |
| October | 123.79 | 123.85 | 122.26 | 123.19 | 123.29 | 123.03 | 122.65 | 115.91 | . . | 115.87 | 118.17 | 118.43 | 119.56 | 120.46 |
| Nov. . . | 123.80 | 124.07 | 123.63 | 122.78 | 123.38 | 122.75 | 122.89 | 116.74 | 117.20 | 116.85 | 118.55 | 120.14 | 119.78 | 120.84 |
| Dec. . . . | 124.00 | 123.46 | 122.53 | 122.29 | 123.24 | 122.64 | 122.37 | 117.45 | 115.23 | 118.30 | 117.35 | 120.50 | 119.37 | 120.02 |
| Average | 123.52 | 123.56 | 123.19 | 122.87 | 123.21 | 122.89 | 122.69 | 116.98 | 117.21 | 116.92 | 116.77 | 120.00 | 119.59 | 119.36 |

| | SOUTH BOSTON. | | | | | | | EAST BOSTON. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month. | 1861. | 1862. | 1863. | 1864. | 1865. | 1866. | 1867. | 1861. | 1862. | 1863. | 1864. | 1865. | 1866. | 1867. |
| January | 115.03 | 113.66 | 115.73 | 110.63 | 114.21 | 114.38 | 112.46 | 95.37 | 96.26 | 95.64 | 90.22 | 96.12 | 93.61 | 91.89 |
| Febru'ry | 115.07 | 114.08 | 115.54 | 110.94 | 113.42 | 114.44 | 111.36 | 93.05 | 94.94 | 93.86 | 92.98 | 97.00 | 96.61 | 92.06 |
| March . | 115.12 | 114.12 | 115.36 | 111.13 | 113.64 | 113.51 | 111.74 | 94.60 | 95.75 | 94.29 | 93.50 | 94.83 | 94.22 | 91.69 |
| April . . | 115.32 | 114.93 | 114.73 | 112.07 | 114.82 | 114.99 | 111.88 | 98.07 | 96.71 | 95.65 | 96.16 | 96.52 | 96.47 | 90.91 |
| May . . . | 113.83 | 115.74 | 112.71 | 111.64 | 115.44 | 114.90 | 111.63 | 97.85 | 96.99 | 93.07 | 97.68 | 96.04 | 95,85 | 89.63 |
| June . . | 112.58 | 114.22 | 111.39 | 109.06 | 114.91 | 114.32 | 111.19 | 96.22 | 95.99 | 91.10 | 94.22 | 93.91 | 93.71 | 91.82 |
| July . . . | 110.91 | 114.23 | 109.75 | 108.57 | 114.36 | 113.96 | 111.53 | 95.00 | 96.13 | 90.43 | 92.34 | 96.82 | 95.35 | 94.60 |
| August. | 112.92 | 114.03 | 109.80 | 109.53 | 113.80 | 114.07 | 111.90 | 97.34 | 93.96 | 91.23 | 92.84 | 95.78 | 93.85 | 94.16 |
| Sept. . . | 112.96 | 114.04 | 109.64 | 110.21 | 113.69 | 113.41 | 111.70 | 95.76 | 95.57 | 91.96 | 95.00 | 94.52 | * | 99.40 |
| October | 114.68 | 114.24 | 109.90 | 112.49 | 112.89 | 112.74 | 111.29 | 95.56 | 91.80 | 95.02 | 97.55 | 93.38 | * | 96.85 |
| Nov. . . | 114.14 | 115.94 | 111.25 | 112.49 | 112.74 | 112.03 | 111.26 | 96.40 | 93.57 | 93.36 | 98.14 | 92.23 | * | 93.47 |
| Dec. . . . | 113.79 | 116.35 | 109.90 | 113.89 | 113.78 | 112.62 | 111.08 | 97.37 | 95.77 | 89.79 | 97.27 | 94.34 | 92.29 | 92.57 |
| Average | 113.86 | 114.63 | 112.14 | 111.05 | 113.97 | 113.78 | 111.59 | 96.05 | 95.29 | 92.95 | 94.83 | 95.12 | 94.66 | 93.25 |

Note. The above average heights are given in feet and parts above marsh level. Maximum high water in the Brookline Reservoir is 124.6 feet above marsh level. By deducting the heights in the City Reservoirs from the heights in the Brookline Reservoir, in each month, we find the loss of head in the different sections of the city at that time.

* East Boston Reservoir was shut off for repairs twenty-seven days in September, the month of October, and three days in November, 1866. Its average height is for nine months only.

## TABLE No. 10.

*Statement of the length of different sizes of Pipes laid, and number of Stopcocks put in, to January 1st, 1868.*

| | DIAMETER OF PIPES IN INCHES. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40. | 36. | 30. | 24. | 20. | 16. | 12. | 8. | 6. | 4. | AGGREGATE. |
| Feet of Pipe laid in Brookline, Roxbury, and Boston Proper..... | 23,082 | 19,991 | 29,696 | 5,773 | ..... | 6,096 | 62,074 | 2,020 | 251,888 | 83,286 | |
| Number of Stopcocks in same ..... | 4 | 6 | 8 | 10 | 1 | 19 | 119 | 5 | 517 | 285 | |
| Feet of Pipe laid in South Boston ..... | ..... | ..... | ..... | ..... | 8,155 | ..... | 18,938 | 2,871 | 94,283 | 27,176 | |
| Number of Stopcocks in same ..... | ..... | ..... | ..... | ..... | 4 | ..... | 31 | 2 | 132 | 64 | |
| Feet of Pipe laid in East Boston ..... | ..... | ..... | ..... | ..... | 15,972 | 1,523 | 16,150 | ..... | 69,802 | 4,754 | |
| Number of Stopcocks in same ..... | ..... | ..... | ..... | ..... | 6 | 3 | 23 | ..... | 92 | 29 | |
| Feet of Pipe laid in Newton and Needham, | ..... | 1,074 | 2,140 | ..... | ..... | ..... | 159 | ..... | ..... | ..... | |
| Number of Stopcocks in same ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2 | ..... | 1 | ..... | |
| Total length of Pipe laid ..... | 23,082 | 21,065 | 31,836 | 5,773 | 24,127 | 7,619 | 97,321 | 4,891 | 415,973 | 115,216 | 746,903, Equal to 141 miles, 2,423 ft. |
| Number of Stopcocks put in ..... | 4 | 6 | 8 | 10 | 11 | 22 | 175 | 7 | 742 | 378 | 3,63 |

## Table No. 11.

*Statement of Number of Leaks,* 1850–1867.

| YEAR. | DIAMETER OF PIPE. | | |
|---|---|---|---|
| | Four inches and upwards. | Less than four inches. | Total. |
| 1850 | 32 | 72 | 104 |
| 1851 | 64 | 173 | 237 |
| 1852 | 82 | 241 | 323 |
| 1853 | 85 | 260 | 345 |
| 1854 | 74 | 280 | 354 |
| 1855 | 75 | 219 | 294 |
| 1856 | 75 | 232 | 307 |
| 1857 | 85 | 278 | 363 |
| 1858 | 77 | 324 | 401 |
| 1859 | 82 | 449 | 531 |
| 1860 | 134 | 458 | 592 |
| 1861 | 109 | 399 | 508 |
| 1862 | 117 | 373 | 490 |
| 1863 | 97 | 397 | 494 |
| 1864 | 95 | 394 | 489 |
| 1865 | 111 | 496 | 607 |
| 1866 | 139 | 536 | 675 |
| 1867 | 69 | 209 | 278 |

These leaks occur from various causes, but can be classified as follows:

One-quarter are caused by the settling of the earth.
" eighth " " " defective joints.
" " " " " the frost.
" tenth " " " defective pipe.
" " " " " " connections.
" " " " " accidents.
" fifth by various causes.

## Table No. 12.

*Statement showing the number and kind of Water Fixtures contained within the premises of Water-takers in the City of Boston, to January* 1, 1868, *as compared with previous years.*

| *1865.* | *1866.* | *1868.* | REMARKS. |
|---|---|---|---|
| 4,797 | 4,774 | 5,074 | Taps. These have no connection with any drain or sewer. |
| 40,184 | 40,496 | 42,099 | Sinks. |
| 16,767 | 17,204 | 18,910 | Wash-hand basins. |
| 5,475 | 5,499 | 5,929 | Bathing tubs. |
| 6,752 | 7,398 | 7,789 | Pan water-closets. |
| 7,317 | 7,563 | 8,394 | Hopper water-closets. |
| 181 | 312 | 246 | " " " pull. |
| 315 | 239 | 297 | " " " self-acting. |
| 213 | 226 | 357 | " " " waste. |
| 498 | 536 | 571 | " " " door. |
| 1,741 | 1,790 | 1,968 | Urinals. |
| 6,087 | 6,365 | 6,806 | Wash-tubs. These are permanently attached to the building. |
| 737 | 756 | 759 | Shower-baths. |
| 13 | 13 | 14 | Hydraulic rams. |
| 715 | 773 | 711 | Private hydrants. |
| 334 | 350 | 388 | Slop-hoppers. |
| 28 | 33 | 46 | Foot-baths. |
| ..... | ..... | 11 | Public urinals. |
| 92,154 | 93,327 | 100,362 | |

TABLE No. 13.

## TOTAL NUMBER OF FIRE HYDRANTS ESTABLISHED UP TO JANUARY 1ST, 1868.

| | |
|---|---|
| In Boston Proper | 1,028 |
| " South Boston | 337 |
| " East " | 196 |
| " Brookline | 3 |
| " Roxbury | 16 |
| " Charlestown | 11 |
| " Chelsea | 8 |
| Total, | 1,599 |

TABLE No. 14.

Statement showing the Number of Houses, Stores, Steam engines, etc., in the City of Boston, supplied with Cochituate water to the 1st of January, 1868, with the Amount of Water-rates paid for 1867.

| | | | | | |
|---|---|---|---|---|---|
| 19,854 | Dwelling-houses, | $252,776 41 | 1,047 | Stables, | 7,898 23 |
| 7 | Boarding " | 253 25 | 12 | Factories, | 391 00 |
| 78 | Model " | 2,061 25 | 7 | Bleacheries, | 114 50 |
| 4 | Lodging " | 82 00 | 72 | Bakeries, | 560 50 |
| 8 | Hotels, | 480 00 | 5 | Ship-yards, | 70 00 |
| 4,395 | Stores and shops, | 41,106 57 | 3 | Dry docks and engines, | 64 00 |
| 172 | Buildings, | 5,942 39 | 59 | Shops and engines, | 3,639 89 |
| 394 | Offices, | 3,079 88 | 20 | Stores " | 1,378 22 |
| 35 | Printing-offices, | 478 75 | 5 | Foundries " | 200 94 |
| 19 | Banks, | 248 50 | 5 | Factories " | 260 42 |
| 18 | Halls, | 258 00 | 5 | Printing " | 200 76 |
| 1 | Theatre, | 9 75 | 1 | Bakery " | 33 00 |
| 28 | Private schools, | 243 75 | 1 | Ship-yard " | 34 00 |
| 15 | Asylums, | 772 25 | 3 | Buildings " | 528 31 |
| 4 | Greenhouses, | 38 00 | 1 | Pottery and engine, | 35 00 |
| 63 | Churches, | 699 50 | 2 | Mills and engine, | 222 91 |
| 3 | Markets, | 697 50 | 44 | Stationary engines, | 1,520 18 |
| 119 | Cellars, | 773 75 | 4 | Armories, | 53 50 |
| 286 | Restaurants and saloons, | 3,926 97 | 2 | Gymnasiums, | 41 50 |
| 4 | Club-houses, | 102 00 | 510 | Hand-hose, | 2,865 00 |
| 1 | Bath-house, | 55 00 | 13 | Fountains, | 103 00 |
| 40 | Photographers, | 1,115 50 | | Gas Light Co., (filling tank) | 434 41 |
| 10 | Packing-houses, | 339 00 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Mill-dam Co., | 266 75 | | Public Library, | 50 00 |
| | Custom House, | 150 00 | | Faneuil Hall, | 40 00 |
| 54 | Steamboats, | 10,300 09 | | Shop (paving department), | 9 00 |
| | Office (Harbor Master), | 6 00 | | Common sewer department (making mortar) and locker, | 56 00 |
| | Office (City Scales), | 9 00 | | Public urinals, | 145 00 |
| | Court House, | 262 50 | | Street sprinkling, | 400 00 |
| | Probate Building, | 47 50 | | J. F. Paul, (contract pipe), | 40 08 |
| | House of reception, | 10 00 | | Building purposes, | 2,263 94 |
| 5 | Fire-alarm motors, | 50 00 | | Contractors for supplying shipping, | 1,889 53 |
| 22 | Fire-engines, hose and hook and ladder houses, | 553 50 | | Measured water, | 123,025 51 |
| 280 | Public schools, | 1,970 00 | | | $478,739 95 |
| 2 | City stables, | 200 75 | | | |
| | Offal station, | 150 00 | | | |
| | Steamer "Henry Morrison," | 192 56 | | | |
| | House of Correction, | 462 00 | | | |

N. B. Received during the year for water used in previous year, $43,393 73

## TABLE No. 15.

*Statement of the amount of Water consumed for each hour on certain days in* 1865, *by actual measurement.*

| HOURS. | Sunday & Monday, Feb. 12 & 13. | Tuesday & Wedn'day, Feb. 21 & 22. | Monday & Tuesday, Apr. 24 & 25. | Sat'day & Sunday, Apr. 29 & 30. | Tuesday & Wedn'day, May 9 and 10. | Wedn'day and Thur. May 17 & 18. | Thursday & Friday, May 25 & 26. | Friday & Saturday, June 2 & 3. | Saturday & Sunday, June 10 & 11. |
|---|---|---|---|---|---|---|---|---|---|
| | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. |
| 12 M. to 1 P.M. | . . . . . | . . . . . | 467,931 | 782,320 | 492,090 | 81,129 | 623,750 | 1,226,418 | 943,593 |
| 1 P.M. to 2 P.M. | 630,562 | . . . . . | 489,250 | 320,443 | 636,126 | 622,835 | 622,250 | 604,164 | 742,031 |
| 2 P.M. to 3 P.M. | 384,214 | . . . . . | 455,679 | 320,677 | 632,781 | 620,265 | 622,125 | 612,456 | 481,281 |
| 3 P.M. to 4 P.M. | 621,352 | . . . . . | 610,430 | 161,408 | 460,656 | 697,140 | 621,750 | 605,293 | 499,949 |
| 4 P.M. to 5 P.M. | 543,652 | . . . . . | 314,250 | 308,533 | 293,532 | 312,016 | 617,216 | 590,977 | 778,029 |
| 5 P.M. to 6 P.M. | 470,504 | 3,140,700 | 314,250 | 458,500 | 490,573 | 773,139 | 465,875 | 602,401 | 470,905 |
| 6 P.M. to 7 P.M. | 320,757 | . . . . . | 295,677 | 475,597 | 613,221 | 538,562 | 616,715 | 549,523 | 318,529 |
| 7 P.M. to 8 P.M | 630,783 | . . . . . | 304,250 | 300,187 | 308,500 | 537,063 | 383,277 | 367,629 | 452,816 |
| 8 P.M. to 9 P.M. | 311,950 | . . . . . | 204,713 | 300,183 | 451,924 | 221,657 | 538,652 | 610,445 | 458,500 |
| 9 P.M. to 10 P.M. | 465,650 | . . . . . | 153,033 | 297,790 | 458,094 | 292,323 | 414,644 | 454,260 | 617,125 |
| 10 P.M. to 11 P.M. | 624,006 | . . . . . | 227,149 | 141,396 | 299,438 | 222,304 | 468,426 | 433,553 | 300,191 |
| 11 P.M. to 12 M. | 775,896 | 1,459,530 | 231,564 | 72,841 | 303,719 | 365,657 | 407,588 | 437,091 | 452,175 |
| 2 M. to 1 A.M. | 618,348 | . . . . . | 154,375 | 59,981 | 299,436 | 217,071 | 225,695 | 284,941 | 295,657 |
| 1 A.M. to 2 A.M. | 4,248 | . . . . . | 227,211 | . . . . . | 453,310 | 517,164 | 382,586 | 300,056 | 445,247 |
| 2 A.M. to 3 A.M. | 8,496 | . . . . . | 231,375 | 134,833 | 303,467 | 365,643 | 382,588 | 377,367 | 295,276 |
| 3 A.M. to 4 A.M. | 466,672 | . . . . . | 154,250 | 303,963 | 457,091 | 221,033 | 316,163 | 222,866 | 297,290 |
| 4 A.M. to 5 A.M. | 540,948 | . . . . . | 158,539 | 327,418 | 311,783 | 301,828 | 475,664 | 377,052 | 304,017 |
| 5 A.M. to 6 A.M. | 399,988 | 1,458,020 | 396,030 | 171,144 | 474,472 | 539,948 | 471,379 | 462,438 | 472,409 |
| 6 A.M. to 7 A.M. | 637,674 | . . . . . | 547,760 | 320,856 | 635,408 | 480,504 | 709,143 | 573,471 | 474,475 |
| 7 A.M. to 8 A.M. | 675,837 | . . . . . | 473,430 | 327,277 | 665,600 | 486,898 | 722,474 | 652,406 | 798,848 |
| 8 A.M. to 9 A.M. | 677,890 | . . . . . | 716,374 | 781,975 | 502,885 | 733,525 | 651,257 | 806,009 | 639,041 |
| 9 A.M. to 10 A.M. | 669,358 | . . . . . | 478,162 | 320,972 | 640,778 | 632,473 | 571,538 | 487,046 | 639,169 |
| 10 A.M to 11 A.M. | 673,549 | . . . . . | 390,253 | 170,874 | 485,180 | 489,908 | 564,731 | 638,772 | 642,297 |
| 11 A.M. to 12 M. | 502,679 | 2,720,700 | 246,750 | 480,635 | 639,956 | 546,970 | 639,520 | 797,799 | 476,351 |
| 12 M. to 1 P.M. | 483,340 | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . | . . . . . |
| | 12,148,353 | 8,778,950 | 8,342,686 | 7,339,803 | 11,310,022 | 10,817,055 | 12,515,006 | 13,074,433 | 12,295,202 |

## TABLE No. 16.

*Consumption of Water. Daily Average Number of Wine Gallons drawn from the Brookline Reservoir.*

| MONTHS. | 1849. | 1850. | 1851. | 1852. | 1853. | 1854. | 1855. | 1856. | 1857. | 1858. |
|---|---|---|---|---|---|---|---|---|---|---|
| January | 1,700,000 | 5,181,700 | 7,233,700 | 8,280,900 | 8,050,500 | 10,695,200 | 9,702,700 | 12,669,000 | 15,089,000 | 12,160,000 |
| February | ..... | 5,214,000 | 7,221,100 | 8,790,300 | 8,643,600 | 10,654,200 | 10,349,800 | 12,791,000 | 14,175,000 | 14,399,000 |
| March | 1,550,000 | 4,841,200 | 6,137,900 | 8,521,100 | 8,202,200 | 9,582,100 | 10,125,600 | 12,504,000 | 13,941,000 | 14,154,000 |
| April | ..... | 4,961,000 | 5,365,200 | 8,048,700 | 7,903,600 | 8,738,500 | 8,540,000 | 10,800,000 | 12,454,000 | 13,465,000 |
| May | 3,600,000 | 5,346,100 | 6,238,400 | 8,350,000 | 8,123,400 | 9,685,300 | 9,103,800 | 10,378,000 | 12,414,000 | 11,423,000 |
| June | 4,300,000 | 6,906,500 | 7,925,000 | 8,033,100 | 8,945,900 | 11,745,200 | 9,984,400 | 11,223,000 | 12,504,000 | 10,867,000 |
| July | 4,800,000 | 8,514,200 | 7,180,200 | 9,608,000 | 8,809,200 | 10,613,800 | 11,056,600 | 13,167,000 | 13,551,000 | 13,621,000 |
| August | 4,100,000 | 8,004,600 | 7,235,000 | 9,709,300 | 8,461,900 | 10,028,100 | 11,120,800 | 12,664,000 | 13,077,000 | 13,141,000 |
| September | 4,800,000 | 6,585,500 | 7,230,600 | 7,920,000 | 8,640,700 | 9,712,400 | 11,710,800 | 11,522,000 | 12,030,000 | 12,745,000 |
| October | 4,550,000 | 4,504,300 | 6,716,600 | 6,930,000 | 8,871,100 | 8,769,800 | 10,771,200 | 11,891,000 | 10,864,000 | 12,969,000 |
| November | 3,800,000 | 4,960,500 | 6,473,500 | 6,637,900 | 8,624,700 | 8,030,200 | 10,383,200 | 11,691,000 | 11,372,000 | 12,143,030 |
| December | 3,600,000 | 5,037,000 | 7,663,400 | 7,195,800 | 9,228,400 | 10,597,600 | 11,307,200 | 13,284,000 | 11,241,000 | 13,075,000 |
| Average for Year | 3,680,000 | 5,837,900 | 6,883,800 | 8,125,800 | 8,542,300 | 9,902,000 | 10,346,300 | 12,048,600 | 12,726,000 | 12,847,000 |

TABLE No. 16. — *Continued.*

| MONTHS. | 1859. | 1860. | 1861. | 1862. | 1863. | 1864. | 1865. | 1866. | 1867. | 1868. |
|---|---|---|---|---|---|---|---|---|---|---|
| January | 14,512,000 | 17,862,000 | 21,106,769 | 17,000,000 | 16,112,000 | 18,954,000 | 13,412,000 | 14,850,000 | 13,511,000 | ..... |
| February | 14,769,000 | 18,901,000 | 20,804,131 | 17,000,000 | 17,328,000 | 18,846,000 | 13,318,000 | 13,385,000 | 13,831,000 | ..... |
| March | 14,480,000 | 15,409,000 | 19,453,344 | 17,300,000 | 16,681,000 | 16,841,000 | 12,027,000 | 12,284,000 | 13,100,000 | ..... |
| April | 13,760,000 | 14,621,000 | 17,151,593 | 15,300,000 | 15,125,000 | 16,506,000 | 11,975,000 | 11,251,000 | 12,770,000 | ..... |
| May | 11,302,000 | 14,790,000 | 16,687,832 | 14,300,000 | 15,407,000 | 16,094,000 | 13,660,000 | 11,076,000 | 12,301,000 | ..... |
| June | 11,639,000 | 17,838,000 | 17,231,984 | 16,600,000 | 16,138,000 | 17,730,000 | 14,391,000 | 11,878,000 | 13,625,000 | ..... |
| July | 13,219,000 | 17,239,000 | 18,897,809 | 16,400,000 | 15,954,000 | 18,112,000 | 13,207,000 | 12,668,000 | 14,250,000 | ..... |
| August | 12,704,000 | 19,297,000 | 18,272,365 | 17,000,000 | 16,980,000 | 16,188,000 | 13,426,000 | 12,441,000 | 14,546,000 | ..... |
| September | 12,389,000 | 17,957,000 | 18,098,259 | 17,000,000 | 17,035,000 | 16,798,000 | 12,624,000 | 11,842,000 | 13,186,000 | ..... |
| October | 12,026,000 | 16,938,000 | 17,987,128 | 17,300,000 | 15,779,000 | 15,479,000 | 11,273,000 | 12,396,000 | 13,518,000 | ..... |
| November | 12,715,000 | 16,862,000 | 16,604,076 | 17,100,000 | 16,028,000 | 14,079,000 | 11,750,000 | 11,262,000 | 12,707,000 | ..... |
| December | 14,586,000 | 19,151,000 | 15,976,362 | 17,000,000 | 16,295,000 | 14,547,000 | 10,877,000 | 11,412,000 | 15,434,000 | ..... |
| Average for year | 13,175,000 | 17,238,000 | 18,189,304 | 16,600,000 | 16,238,500 | 16,681,000 | 12,662,000 | 12,223,000 | 13,565,000 | ..... |

## Table No. 17.

## BOSTON WATER RATES.

Section 1. Every dwelling-house, occupied by one family, $6; by two families, $8; by three or more families, $10; also $1 on every $1,000 or fraction of a thousand above $1,000 assessment.

In addition to the foregoing rates, there shall be charged to each dwelling-house, in which a water closet or bathing tub is used, the sum of.....$5

The following rates for the use of the Cochituate water in model houses, so-called, shall be hereafter charged, viz: for each tenement having water fixtures within the same, $3 annually; and for each tenement not having water fixtures within the same, but taking the water from general fixtures, used in common with other tenements, $2 annually. And in addition to the foregoing rates, there shall also be charged for each such tenement, in which a water closet or bathing tub is used, $3 annually.

The following rates for the use of the Cochituate water in buildings used and occupied for offices shall be charged, viz: for each office having water fixtures within the same, $5 annually; and for each office taking the water from fixtures used in common with other offices, $2 annually. And in addition to these rates there shall be charged for each pan or self-acting water closet, $3, and for each hopper water closet, $5 annually.

*Hotels*, *taverns* and *boarding-houses*, (said boarding-houses being valued for the assessment of taxes over $15,000,) not including water for baths or for uses without the house, shall be charged for each bed for boarders and lodgers within the same.....$3

Provided, that in no case shall any hotel, tavern or boarding-house be charged less than if a private dwelling-house.

For each tenement occupied as a *store*, *warehouse*, *office*, *shop*, or for *purposes not included* in any other classification, and not requiring more than an ordinary supply of water.....$6 to $25

For each water closet, more than one, supplied for the above, $5 additional.

And for each urinal, wash hand basin or sink, more than one, $2.50 additional.

*Private stables*, including water for washing carriages.....$6

And for each horse over two.....$2

*Livery stables*, including water for washing carriages, for each horse.....$2

*Omnibus stables*, for each horse.....$1.50

*Truckmen's stables*, for each horse.....$1.25

Provided, that in no case shall any stable be charged less than $5.

The right to attach a *hose*, of not more than five-eighths of an inch orifice, for washing windows or sprinkling streets, in addition to the charge for other uses ..... $5

Corner lots.....$10

But *no hose* shall be attached or used in any *stable*, for washing horses or carriages, or for any other purpose whatever, except for extinguishing fires.

*Refectories, confectioneries, eating houses, market and fish stalls, provision shops, refreshment and oyster saloons*, according to the quantity of water used, from .....$8 to $50

*Public baths*, for each tub.....$5

Every *printing office*, according to the number of presses used, not including the supplying of a steam engine, from.....$6 to $40

Stationary steam engines, working not over twelve hours a day, shall be charged by the horse power, as follows: for each horse power up to and not exceeding ten, the sum of $10; for each exceeding ten and not over fifteen, the sum of $8; for each horse power over fifteen, the sum of $6.

Every *railroad corporation*, for supply of *locomotive engines*, according to the quantity used, as ascertained by meters or otherwise, and also for supply of *passenger stations*.

Steamboats shall be charged for estimated quantities of water used for boiler and domestic purposes, at the rate of 6 cents per one hundred gallons, provided, however, that in cases where meters are applied, the charge shall be at the same rate as for manufacturing purposes.

And for the use of hose for washing decks at the following rates:

For a one-inch nozzle.....$5.00 per hour.
" five-eighths-inch nozzle..... 4.00 "

Provided, however, that no water shall be allowed for washing purposes, except by special permission from the Cochituate Water Board, under a penalty of $10.

For building purposes, for each cask of lime or cement, 7 cents.

*Fountains* are only to be supplied with water at the discretion of the Cochituate Water Board; and shall be charged upon the estimated quantity used each day, for each one hundred gallons daily consumption.....$5

*Bakeries.* For the average daily use of flour, for each barrel, the sum of $3 per annum; provided, that in no case shall any bakery be charged less than $6.

Manufacturers and other parties supplied with water through meters, or by estimated quantity, shall be charged at the rate of 3 cents per one hundred gallons.

When water is required for *purposes which are not specified* in the foregoing tariff, the rate shall be fixed by the Cochituate Water Board.

SECT. 19. Whenever two or more dwelling-houses, or other estates, are valued together, for the assessment of taxes, it shall be the duty of the Water Regis-

trar, under the direction of the Cochituate Water Board, to make a separate valuation of the same; and whenever a portion only of any estate is justly chargeable for any water rate, it shall be the duty of the Water Registrar to make a proper valuation of the said portion; and the water rates hereinbefore provided shall apply to such valuations respectively.

SECT. 20. The Cochituate Water Board shall have power to ascertain, *by meters*, the quantity of water used in any case; and the proprietors or persons having charge of the *hotels*, *taverns*, and *boarding houses*, mentioned in the fourth section of this ordinance, shall also have power to place within their premises, at their own expense, a *sufficient water meter*, to be approved by the Water Registrar, for the purpose of measuring the quantity of water by them respectively used. And when in any case the quantity used shall be ascertained and measured in manner before mentioned, the Cochituate Water Board may establish a water rate therefor, instead of the specific rate hereinbefore established. Provided, however, that the said rates shall in no case be less than that hereinbefore directed to be charged to brewers, distillers, and other business requiring a large supply, for uses not specified under specific regulations.

SECT. 21. The Cochituate Water Board shall have power to establish such regulations as they may deem expedient for the construction of *water closets* hereafter; and the water shall not be supplied to any building, unless the said water closets shall be made conformable to the said regulations.

SECT. 22. No charge shall be made for the right to insert a pipe of not more than one inch in diameter, at the expense of the water taker, and to be used only in case of fire.

SECT. 23. All ordinances and parts of ordinances inconsistent with this are hereby repealed.

SECT. 24. This ordinance shall take effect on and after the first day of January, in the year eighteen hundred and sixty.

## Table No. 18.

The following table exhibits the Yearly Revenue received from the sale of Cochituate water since its introduction into the City, October 25th, 1848:

| | | | | | | |
|---|---|---|---|---|---|---|
| Received by Water Commissioners, as per Auditor's Report, in | | 1848 | | | | $972 81 |
| From January 1, | 1849, to January 1, | | 1850 | | | 71,657 79 |
| " | " | 1850, | " | 1851 | | 99,025 45 |
| " | " | 1851, | " | 1852 | | 161,052 85 |
| " | " | 1852, | " | 1853 | | 179,567 39 |
| " | " | 1853, | " | 1854 | | 196,352 32 |
| " | " | 1854, | " | 1855 | | 217,007 51 |
| " | " | 1855, | " | 1856 | | 266,302 77 |
| " | " | 1856, | " | 1857 | | 282,651 84 |
| " | " | 1857, | " | 1858 | | 289,328 83 |
| " | " | 1858, | " | 1859 | | 302,409 73 |
| " | " | 1859, | " | 1860 | | 314,808 97 |
| " | " | 1860, | " | 1861 | | 334,544 86 |
| " | " | 1861, | " | 1862 | | 365,323 96 |
| " | " | 1862, | " | 1863 | | 373,922 33 |
| " | " | 1863, | " | 1864 | | 394,506 25 |
| " | " | 1864, | " | 1865 | | 430,710 76 |
| " | " | 1865, | " | 1866 | | 450,341 48 |
| " | " | 1866, | " | 1867 | | 486,538 25 |
| " | " | 1867, | " | 1868 | | 522,133 68 |
| | | | | | | $5,739,159 83 |